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From Manganese to Selenium

Procedure for Changing a Tank of Glass

By IRVING E. ADAMS*

Selenium, or its compounds, is now so generally used for decolorizing soda-lime flint glass made in tanks in this country, that an article dealing with the correct conditions for effecting the transformation from a manganese basis might seem superfluous. Undoubtedly technically trained men employed by manufacturers of prepared decolorizer compounds, as well as local plant chemists, have done much toward standardizing conditions. Yet, in many instances, to the writer's knowledge, the change occasioned serious losses in production, and there may still be some manufacturers clinging to the use of manganese through fear of possible production disturbances.

As a decolorizing agent, selenium possesses three distinct advantages over manganese. It is cheaper, the saving amounting to approximately ten dollars per day on a twenty-five ton tank; it is easier to maintain regularity of color from day to day by its use; and it permits the maintenance of high temperatures over Sunday, which is essential as an aid in "plaining up" the glass when the tank is being pulled hard during the week.

Several very excellent articles have recently appeared in the technical journals, discussing the properties and reactions of selenium and its compounds, as applied to soda-lime tank practice, so I am restricting this endeavor to a description of the procedure that I have been following, when called in a consulting capacity to actually make the change at a plant.

Let us assume that the change is to be made at the beginning of the fire. It can be made at any subsequent time, but minor color disturbances are less harmful at the start, as the glass is often not good enough to pack for the first two or three days, for other reasons aside from color. To make the illustration more definite, let us further assume that we are making the change on a twenty-five ton tank, making a general line of narrow neck bottles by a feeder and automatic machine process.

Preliminary instructions inform the manufacturer that he may utilize the manganese cullet from the previous fire, that he may gradually deplete stocks of manganese, nitre, powdered blue, and antimony oxide, reserving such amounts as are later specified; that he must purchase a carload of high-grade selenium cullet, and further purchase specified stocks of borax, arsenic, cobalt oxide and powdered selenium.

Enough manganese cullet is filled into the cold tank to cover the throat to a depth of six to eight inches when melted down. It is so distributed within the tank that the side walls and division wall will be thoroughly glazed. It is preferable not to place any cullet in the working end, though this point is not insisted upon, if that has been the previous practice at that particular plant. The cullet is well covered with a sprinkle composed of 40 to 50 pounds of manganese, and perhaps 150 pounds of nitre. When entirely melted down, more manganese cullet (but this must be distinctly pink in color) may be added at the dog house, until the tank is filled to within 15 inches of the working level. Then a manganese batch, of the same composition as used in the previous fire, and containing sufficient manganese to keep the color right, may be introduced in conjunction with the cullet in the proportion of sixty-five per cent (65%) by weight. This procedure is maintained until the writer reaches the plant, three days before the operation of the unit is planned.

A second letter of instructions has before this reached the manufacturer, specifying the construction of a rotating drum for mixing color, requesting that the hopper be empty the morning of arrival, and that the carload of selenium cullet above mentioned be available for use at the dog house. The first move on reaching the plant is to take proofs at both ends of the tank. If the color is good at this stage, absolutely no disturbing effects will accompany the transformation to a selenium basis. If the color is high in the working end, but low at the dog house, it is still possible to start off with good glass, but only by the use of a high stack and a clean fire. If the proofs are low at both ends, at least three to four days of green glass may be expected. In this last case, it is futile to attempt to hurry matters by using an undue amount of decolorizer mix, for it only means that after the color has reached normal, a yellow or brownish cast will persist in the ware for several days.

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The next step is to make up a batch of color and rotate it in the drum until the powdered selenium and cobalt oxide are thoroughly disseminated throughout the inert materials, in my practice, namely: arsenious oxide and pulverized limestone. The mix is made sufficiently dilute, so that about a pound and a half is necessary to decolorize a batch containing a thousand (1,000) pounds of sand of good quality.

The batch that I usually substitute for the manganese batch used up until now (in the case of narrow necked machine made bottles) is as follows:

Sand	1,000 pounds
Soda	390 pounds
Burnt Lime	110 pounds
Arsenic	2 pounds
Borax	2 pounds

Cullet 350 pounds to 400 pounds of sand.
Decolorizer mix as needed.

The hopper, or the bin, if filled by hand, is now filled with this new batch containing an amount of the decolorizer mix, indicated as being necessary from an inspection of the dog house proof. The tank is opened up as regards stack and air to get the checkers hot, thus assuring good melting conditions, and to maintain a neutral or slightly oxidizing atmosphere within the tank.

From now on I work closely with the man who is to make the glass when I leave, for his previous experience with manganese will be of little value in interpreting the selenium proofs, and he must be taught how to modify the composition of the color mix to meet varying tank conditions. Usually a week is sufficient to impart this information.

Only enough batch is made up to last a few hours at a time during the next two or three days, in order to permit changes in the amount of decolorizer mix, as indicated by the proof. These proofs are best taken in the dog house, immediately before a fill, and at a point inside the mantle block which has been cleared by the use of a shovel full of cullet. They are best taken with a spoon- or saucer-shaped ladle, and the gathers made as nearly as possible from the same depth of metal. The gather is poured on an iron plate, and when cold the broken pieces are transferred to a white tile placed before a window with a north exposure. Successive proofs are retained in proper sequence over a period of a week.

For two or three days the proofs will exhibit the characteristic pink manganese color which is natural considering that the bulk of the glass in the tank has been decolorized by that agent. In a short time, however, the peculiar rose color of selenium will begin to manifest itself, and once the shade of color necessary to hold at the dog house has been definitely established, it will be found comparatively easy to maintain. The cullet in the barrels from the machines should still exhibit a very faint rose tint. If the lehrs are not too hot or pulled too slowly, there will be no gain or loss of color in this operation.

Any of the standard prepared decolorizer mixes may be equally well substituted for the mix that I usually employ. The writer has visited many plants employing these mixes that were making most excellent glass. The mix that he uses is perhaps cheaper, and has the advantage of flexibility as regards the amount of cobalt oxide used.

Some general comments on the use of selenium may be of interest. The tank will require less decolorizer mix, the hotter it is and the harder it is pulled. If at any time the pull is decreased, and the amount of decolorizer mix held constant, the color will become higher. Most authorities hold that selenium functions best under slightly reducing conditions, but within the range of the writer's experience, a neutral or faintly oxidizing atmosphere is preferable. The writer finds an occasional firm which, having gone over from a manganese basis, still persists in the use of some nitre in conjunction with selenium; but this is against both good theory and good practice.

It is sometimes stated that the best manganese tank glass is better than the best selenium tank glass. This may possibly be true, but it in nowise offsets the tremendous manufacturing advantages which has given glass decolorized with selenium such prominence in America today. Any practical glass maker who has had the experience of working with both decolorizing agents, would never voluntarily return to a manganese basis.

In concluding it might be interesting to answer an often asked question as to how much manganese cullet can be safely used when operating on a selenium basis. Foreign cullet of unknown origin may be used mixed with an equal amount of good cullet from the packing room, up to a total of four shovelfuls to five shovelfuls of batch.

By Courtesy of General Electric Company.

The Largest Incandescent Lamp?

The 30,000-watt lamp here illustrated was developed and constructed at the National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio, primarily for use in motion picture studios where it is said to give a light which is the nearest approach to actual sunlight ever produced.

Its wattage is 1,200 times that of an ordinary household lamp. The bulb is 12 inches in diameter. The lamp is 18 inches high. The light it produces is equal to the combined light from 2,400 ordinary household electric lamps.

Modern Glass Factory Equipment

SECOND ARTICLE*

By W. S. MAYERS†

Air Compressors

The advent of pressing and blowing machines, displacing hand work, has created a necessity for numerous pieces of auxiliary equipment such as air compressors, blowers, vacuum pumps, gas compressors, etc., and these have greatly increased the demand for power.

W. S. MAYERS

The air pressure required is generally under 60 pounds and the selection and installation of compressors for this service usually present no great difficulties.

High speed single stage compressors with short belt motor drives are favored generally on account of their comparatively low first cost and small floor space requirements, but where steam at constant pressure is available the year round, steam driven compressors offer some advantages, especially in cases where the exhaust can be utilized for factory heating.

The demand for compressed air is usually fluctuating, depending upon the number of machines at work, and the argument for one large unit in promotion of efficiency and continuity of service does not hold in this case.

In designing a compressor layout to supply air to several machines it is a good plan to divide the installation into two or more units having capacities which are multiples of the requirements of a single machine, all being interconnected.

For example, in a plant with eight machines each requiring 250 cubic feet of free air per minute, a desirable installation would comprise three 250, two 500 and one 750 C. F. M. compressors, by which the demands of any combination of the eight machines can be met.

The combined capacity of these six compressors is 25 per cent above the maximum demand and this reserve capacity is usually worth paying for as, with the eight machines running and no reserve capacity it would be practically impossible to maintain constant compressor service indefinitely.

Each compressor must have a reliable automatic unloading device in order that, although running, it may not function as a compressor after a pre-determined pressure has been reached. These devices never remove all the load, and as a rule not more than from 40 to 50 per cent of it, during the unloaded periods. For this reason, in the interest of power conservation, it is important that the compressor output be maintained with but a small excess over the demand at all times. In order to reduce the heavy fluctuations in the demand for power due to unloading, it is a good plan to adjust the unloaders in such a manner that one compressor may take care of the fluctuations in demand for air, allowing the others to operate without unloading.

Electric power companies in recent years have acquired the habit of placing on their power circuits instruments which record peak loads constantly during 15-minute periods, and the highest peak during the month is taken as a basis in figuring the demand charge. Thus if several compressors with large over-capacity should happen to take their loads simultaneously during one of these 15-minute periods, and this is liable to happen after a temporary stoppage of the compressors, the power bill for the whole month would be considerably increased thereby.

In some of the newer designs of compressors the unloading is accomplished by means of increasing and decreasing the cylinder clearance automatically by pressure control in small steps, thus doing away with violent fluctuations in power demand.

The intake pipe from each compressor should lead to a main intake which extends upward through the roof in order that clean, cool air may be obtained. Dust laden air from producers, batch handling machinery and cullet crushers must not get into compressor intakes.

In practice most compressors get an excess of cylinder oil and cooling water in the interest of supposed "safety first," and intelligent supervision of these matters will result in considerable savings. In most plants these machines seldom or never get the soap and water washouts and other attentions recommended by their builders. An excess of cylinder oil is also objectionable in that it causes carbon deposits on the discharge valves and air passages.

Blowers

Blowers are essentially air compressors, the distinction being that the blowers handle large volumes at low pressures and they are usually of the rotary type.

Positive blowers in common use are not provided with unloaders and any excess capacity must be wasted through relief valves. This waste may amount to a large item where the demands are variable unless means are employed to restrict the output, such as variable speed motor drives or mechanical speed variators.

In the positive rotary type having two cylinders with interlocking vanes, the fast running gears are sources of considerable trouble and in the eccentric single rotor type with radially sliding vanes the wear is heavy under constant usage.

The centrifugal air compressors, so called, and designed for the duty usually pertaining to the older positive blowers, are in many respects superior to the latter and are coming into general use.

*The first article appeared in the October, 1922, issue.

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In general characteristics they are almost identical with the centrifugal fan, the difference being chiefly in the matter of speed, pressure, and volume of air handled.

The chief advantages of the centrifugal over the positive blower lie in the fact that in the former there are no wearing parts except the bearings which, in the single stage, are the motor bearings, and in that they require no unloading nor speed variation in response to fluctuating demands. In other words throttling the discharge or intake of the centrifugal compressor has no effect except a reduction of volume and power input and a certain decrease in efficiency.

The disadvantages of the centrifugal as compared to the positive blower lie in the fact that they are higher in first cost and in that in single stages they are limited to about four pounds pressure when direct connected to a motor with a speed of about 3,500 revolutions per minute. Positive blowers may, within their pressure limits, operate in parallel feeding into a common main, while centrifugal compressors meet the difficulties above recited in connection with centrifugal fans. All positive blowers are more or less noisy in operation, some more than others, while the centrifugal compressors make scarcely more noise than do the motors which drive them.

With all points considered the single stage centrifugal seems to have a considerable margin of good points in its favor as compared with any type of positive blower for any service requiring a pressure of four pounds or under. For higher pressures the cost of the multi-stage centrifugal is far in excess of that of the blower and where continuous duty is not the prime factor the latter has the advantage.

Raw Material Storage Bins

In figuring the combined capacities of the storage bins for batch ingredients, the combined melting capacities of the various furnaces served constitute the principal factor and this is modified by the distance from the factory to the sources of supply of batch materials, and conditions of transportation service.

Under average conditions the bin capacity should be sufficient for two weeks' run without replenishing, and with all the furnaces in full operation. If the bin capacity of two weeks' run should prove excessive in ordinary times the bins may be kept partly filled, but the reserve capacity means fairly good insurance against shut-downs during possible strikes at the sources of supply or on the transportation systems.

An inspection of various factories shows a great variety in the design of batch storage bins, some being built upon the ground and requiring a considerable amount of manual feeding of the conveyors; others having hopper bottoms and gates built over tunnels in which gathering cars or conveyors are operated, while in some plants the bins are located at an elevation above the furnace room so that weighing and mixing cars may receive their charges from hoppers in the bin bottoms and travel over the tops of a series of small furnace bins, discharging their contents directly therein.

The prevailing design at the present time seems to favor the second class above named wherein the weighing and mixing car is electrically operated, traveling at or near the ground level in a passage under the bins and discharging its contents into a track hopper from whence it is carried to the small furnace bins by a system of bucket elevators and conveyors.

Wooden bins, although cheapest in first cost, are little used today as they lack durability and are difficult to maintain water-tight, are not fire-proof, and require internal bracing. Steel bins, generally and preferably cylindrical in construction, are in common use and have the advantages of fair durability, rapidity of construction and erection and neat appearance. They have a rather serious defect in cold weather due to the condensation of moisture on the inside of the plates, a defect not serious with sand but of considerable consequence where the contents are soda ash or lime.

In recent years the tendency is towards the construction of bins of reinforced concrete, or hollow tile packed with concrete and reinforced at each horizontal joint, and also vertically, both types being generally cylindrical in design and placed close together in straight rows on reinforced concrete foundations.

The tile bin has the advantage over the concrete type in being much more impervious to water, but with an adequate water-proof coating on the concrete bin the choice between the two will be determined largely upon the matter of first cost. Either type is covered preferably with a reinforced and water-proofed conical concrete roof with a slope of about 35 degrees from the horizontal.

In steel bins hopper bottoms of heavy plate are readily constructed, and in the concrete type hopper bottoms may also be used, the construction of which, though presenting some difficulties, may be made easier by the use of steel plate forms.

The construction of hopper bottoms of reinforced tile, although feasible, has not come into general practice.

In the usual construction of the concrete and tile bins, the bottoms consist of flat concrete slabs, each with one or more openings fitted with gates. Complete discharge by gravity will not, of course, take place in this construction, but the material remaining, after full discharge by gravity takes place, may be considered as forming a hopper bottom and may remain undisturbed, its volume being deducted from the capacity of the bin removable by gravity.

In case of a serious shortage of batch material this hopper-forming material may, of course, be discharged by hand through the openings in the concrete slab, thus securing the full capacity of the bin. In the soda ash bins the hopper material may not be recoverable and workable if it has been stored several months as this substance cakes and becomes unfit for use in time, due principally to hydration.

In laying out plans for bin structures the capacity of each bin, or combination of units for each of the principal batch ingredients, should be figured on the basis of volumes rather than weights in order to obtain well balanced storage capacities.

As the weight of dry sand is approximately 87 pounds, 58 per cent soda ash, 71 pounds, and burnt pulverized lime 34 pounds per cubic foot, and as the batch mixture is roughly in weight proportions of 9, 3.5 and 1, respectively, the proportions by volume in the mixture will be approximately 4, 2 and 1, respectively.

A storage layout comprising three bins whose relative capacities are in the above proportion is not to be recommended, for the reasons that in a large plant the sand and soda ash bins would be very large and the variation in heights and diameters would be serious obstacles in designing the mixing and conveying equipment.

The usual practice is to construct a series of bins of uniform dimensions in straight rows, and in order to obtain the above named proportion as to capacities there would be required 4 bins for sand, 2 for soda ash and 1 for lime. For a plant with small or medium output 7 separate bin apartments would generally be considered an excessive number. For plants of this size a good layout would comprise 4 bins as shown in Fig. 1, one of which is divided into two equal compartments by a partition wall, one of these compartments being for lime storage and the other for crushed cullet.

The unloading of soda ash and lime is a very disagreeable job, especially during the Summer months, on account of the fine dust, and this dust is often carried by the wind into nearby buildings. During recent years pneumatic systems for handling these materials have been developed and are in successful operation in several plants not connected with the glass industry, but they have not yet been extensively used in glass factories.

The pneumatic conveyors are almost identical in operation with the vacuum carpet cleaners and entirely remove the dust nuisance. They require, however, rather expensive installations and use from four to six times the amount of power which would be required by ordinary elevators handling the same material.

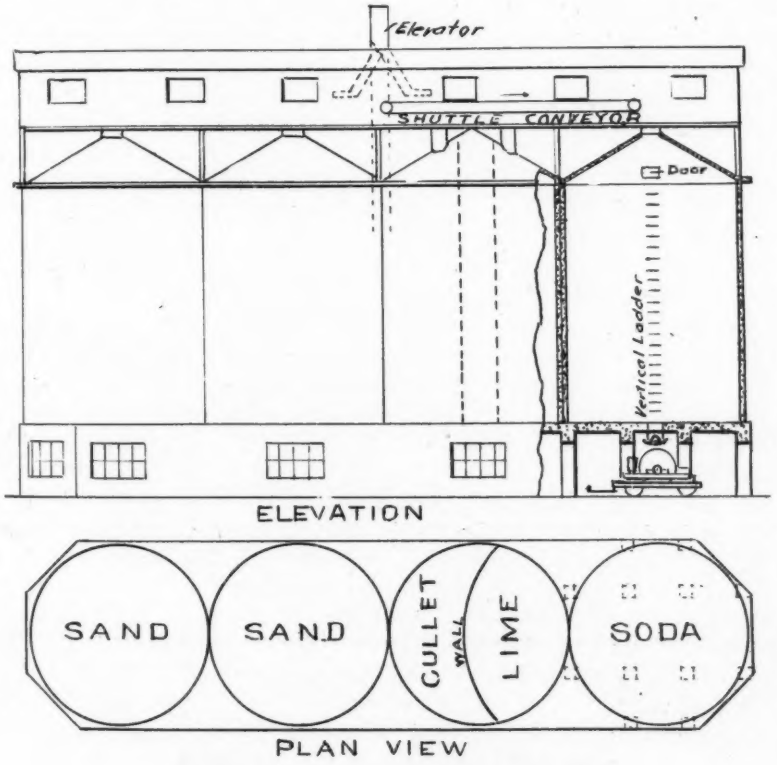


FIG. 1. TYPICAL BATCH STORAGE BINS

Notes on Reheating of Glass Electrically

By E. F. COLLINS*

The electric metallic resistor furnace is an ideal means for reheating glass, whether this be for the sake of forming, molding or annealing. It possesses also such possibilities of close temperature control that it is valuable for holding any desired temperature combinations required for drawing or rolling of glass.

Some who have had no experience in the heating of glass feel that it cannot be heated so quickly electrically as by convected heat. Electric heating is in the main done by radiant heat. Many have observed that glass is transparent and does not intercept the rays of the sun and hence have assumed that it is completely diathermous. This, however, is not true. Glass is about as opaque to non-luminous heat radiation as black glass is to visual rays. Common glass is transparent to vibrations of light or heat beyond the violet rays of the solar spectrum, but is very athermous to the longer heat rays—*e.g.* at 100 deg. C.—2.6 millimeters of glass intercepts all heat radiations, while at 390 deg. C. it intercepts all but 6 per cent.

The ratio of convected heat to radiated heat in the metallic resistor furnace varies from about 20 per cent at 500 deg. F. to about 3 per cent at 1,600 deg. F. Hence as already stated the reheating of glass at temperatures required for molding is secured almost entirely by radiant heat.

It is an easy matter to build furnaces that will uniformly deliver radiant heat to the charge, and hence a very close and practically ideal control of temperature is secured.

This enables heat cycles to be followed up and repeated that are very close to the critical temperatures and hence speed and high grade uniform product is secured.

Tests made in molding glass, as for example, spectacle lenses show that uniform heating without mushing and fusing may be successfully carried on; each blank being at the same temperature molds in the same identical way. Whereas, with gas heat the same temperature cannot be approached in the blank without overheating. Blanks were heated electrically which were proper for molding and which at the same time possessed sufficient viscosity to prevent losing their form under their own weight. This was impossible in the gas furnace.

It is evident that electric heat offers such great advantages in reheating glass, that manufacturers should carefully investigate its possibilities in connection with processes involving heating of glass where a uniform heat and duplication of results are of importance.

*Industrial heating department, General Electric Company.

Fire clay mortar works best after standing 24 to 48 hours. Mix it a couple of days before needed.

Bead Making at Murano and Venice*

[The publication in an earlier issue of a short article on Venetian Glass Beads having inspired requests for further particulars, we begin here a detailed account of the industry, prepared some time ago by Consul B. Harvey Carroll, Jr., Venice, Italy.—EDITOR.]

Glass making in Venice is of remote antiquity. By a law of November 8, 1291, the authorities of Venice, to avoid the risk of fire, ordered the glass-making industry to be transferred to the adjacent island of Murano, referring in the decree to the "ancient traditions of the populace there dedicated exclusively to glass making." Ever since, Murano has been the most important center for handmade glass and glass-bead manufacture in the world.

In recent years certain kinds of handmade beads that must be worked and ornamented individually over the blowpipe and certain processes in the manufacture of machine-made beads, such as stringing and the polishing and glazing of some types, have been again transferred to Venice labor. Most of the loose stringing of beads is carried on by cottage labor in Venice, and the processes for the manufacture of bead articles, such as purses, curtains, flowers, and design work, are domiciled again in Venice, leaving in Murano the glass and bead foundries.

The island of Murano lies less than a mile distant over the lagoon north of the city of Venice. Its population is chiefly engaged in the various glass industries, including bead making.

CONSOLIDATION OF THE MURANO BEAD COMPANIES

Until about 20 years ago there were a number of competing companies engaged in bead making at Murano, but at that time (1896) 11 companies consolidated, forming the Società Veneziana Per l'Industria delle Conterie, whose paid-up capital stock is now 4,500,000 lire ($868,500 at mint rate). This company enjoys a complete monopoly of the bead-making industry, has been very prosperous, and does a world exporting business on a very large scale, shipping to Africa, India, Oceania, Asiatic countries, Europe, and the Americas. It makes the beads that are used as money by certain tribes in the Kongo and in German West Africa and ships many thousands of tons of bead ornaments to the savage as well as the civilized nations of the world.

The offices of the company are in a magnificent old palace at Murano, the Palazzo Trevisan, which boasts frescoes by Tiepolo. Nearby are the foundries and factories, covering many acres of ground. Before the outbreak of the European war this company kept in storage more than 2,000,000 kilos (4,409,245 pounds) of manufactured beads. At the present time less than one-fourth this quantity is in stock, and production has greatly decreased, owing to difficulty in securing fuel and raw material.

The first process of making beads is making glass compounded of soda, sand, and various minerals according to the color desired. The yellows and oranges have a large admixture of lead. It is introduced in the form of an oxide known as "minio." This minio is, I believe, oxide of lead, and comes in several grades according to the vividness of the color, ranging from deep orange to red. (The word is sometimes translated vermilion, but vermilion is properly a mercuric sulphide, usually obtained from cinnabar.) Minio was formerly purchased from England and Germany, but is now made in Italy, that used at Murano being supplied by Venice firms.

RAW MATERIALS USED—MINERAL COLORS

The fondant for ordinary types of beads had formerly a base of Egyptian natron (native sodium carbonate). Nitrate of soda from Chile and crude niter (saltpeter), refined carbonates of soda, sulphate of soda, refined niter, potash, cryolite (a fluoride of sodium and aluminum produced in Greenland, used for obtaining soda and alumina), and especially the highly refined Solvay soda used as a solvent for sand (formerly imported from France, now made also in Italy), figure in the fondants required for the higher types of beads. Since the last years of the last century feldspar has been used as a solvent agent on a large scale. The first used came from Turin and England.

The coloring materials are all mineral, including in recent years various oxides unknown to the glassmakers of antiquity, especially oxides of cobalt, chromium, and uranium. The more important coloring materials are minio, compounds of manganese, copper (from which a great variety of colors are obtained), iron, zinc, arsenic, antimony, silver, gold, and zaffara (a sort of mixture of which cobalt is the base, used for tinting glass blue).

Cobalt in its various combinations gives deep shades of blue and was a coloring agent known to the Egyptians, as was also copper. Silver was used by the ancients to give a yellow-gold color, but the master glassmakers now know how to obtain the same shades without the use of silver. The first one to obtain a formula was a certain Giovanni Giacomuzzi. This maker also tried to produce the deep ruby or pigeon-blood color for which gold is the only successful coloring agent, and marketable shades have been produced, but none that compare with the ruby glass of the old makers which was colored with gold. This glass is known as rubino. Most of the secrets of the trade lie in the color formulas, which will naturally not be divulged. New colors and shades and combinations are constantly being formed, so that Venetian beads run the entire prismatic scale.

THE FIFTEEN STEPS IN BEAD MAKING

The processes of bead making are often said to be three, to wit, making the glass, making the canes, making the beads out of the canes; but so simple a classification is not instructive. A better division is obtained by following the processes of the industry itself as seen at Murano.

(1) Compounding the materials; (2) fusing the materials into the fondant or molten glass; (3) cupping the fondant to prepare the orifice that will run through every cane and every bead; (4) pulling the fondant into long hollow tubes; (5) cutting the tubes into canes of about 1 yard in length; (6) sorting the canes according to diameter; (7) clipping the assorted canes into bead lengths and fanning out the powdered glass; (8) filling the orifices of the sharp-edged beads

*Commerce Reports.

with a composition of charcoal and lime, mixing the beads thus filled with a quantity of sea sand, re-fusing in revolving crucibles to eliminate the sharp edges and round the beads, and cooling; (9) fanning out the sea sand and mechanically sorting the beads for size; (10) mechanical sorting for perfect perforation; (11) in some cases polishing or lucidation; (12 and 13) stringing or mechanical threading on fine metal wires; (14) sorting strung beads for color; (15) packing for shipment.

This list of processes will cover the manufacture of all the smaller beads produced in bulk, and, in fact, of all one-color beads not hand-made. Taking up these processes in their order, it may be noted that all except the first are subject to inspection and have, in fact, been seen by the consul.

COMPOUNDING AND FUSING

1. Compounding the materials. This is done according to formulas more or less secret out of the materials already enumerated and others such as carbonate of lime, cream of tartar, and various minerals. At present the basement of the immense plant of the Società Veneziana is used as a storage room where soda, potash, sand from Fontainebleau, minio, and other minerals for composing the fondant are kept.

2. The glass is fused into the molten mass or fondant in immense crucibles, lined with fireproof tiling and clay, some of which hold 5 and 6 tons of molten glass. The fuel is Newpelton coal, of which the normal annual consumption is 8,000 tons a year. (Cardiff and Pocahontas coal do not serve so well.) The degree of heat obtained varies from 1,000° to 1,600° C., as the materials must be exposed to a heat of 1,000° before they fuse properly. The immense pots or crucibles are covered over, lined with fire clay, and have orifices or portholes through which can be seen the glow of the melted glass, which might be taken for boiling candy. (These furnaces are built by Engineer Spregiani, of Milan.)

HOW THE HOLE IS MADE

3. About the crucible are workmen with great tubes of iron like a section of gas pipe 12 or 15 feet in length, called ferri da canne, which they dip through the portholes into the molten fondant and take out a doughlike mass, which is then pounded on metal tables or anvils until it begins to change in color from white to red. Roughly rounded by this process, the doughlike mass on the end of the rod is then opened by another workman with an instrument called a borsetta, that appears to be a giant pair of spring pincers, and the fondant is scooped and pressed out as if it were a dumpling being prepared for an apple.

This scooping out creates the orifice or hole, which ordinarily remains through all other processes until the beads are finished and complete. This cupped mass is again thrust into the oven and heated to white heat and almost the consistency of glue without being allowed to collapse or lose its cupped form. It is again taken out of the crucible, and another workman, provided with an iron rod having a broad, blunt end, presses that end against the top of the fondant cup, to which the heat causes it to adhere.

4. As soon as the second rod adheres the two men walk away from each other, pulling out the melted glass between them, just as candy is pulled or as a child pulls his chewing gum into a thread. Cross-ties are laid at intervals over the floor, and on these the rope of glass is supported. So ductile is the fondant that a mass the size of a loaf of bread can be stretched for a distance of about 300 yards. Even when the fondant is pulled out to the thinness of a cambric needle it remains a pipe or tube, the bowl of the cup growing ever smaller but always remaining hollow. This fact renders bead making in bulk possible.

CUTTING, SORTING, AND CLIPPING THE CANES

5. As it cools this tube or pipe (which often resembles an unbroken filament of vermicelli) changes from white to red and from red to the permanent color given it by its mineral coloring matter. The size of this tube will depend on three things:

(*a*) The fineness and character of the materials of which it is composed, which will affect its ductility, especially the quality and quantity of soda used.

(*b*) The size of the cupped mass drawn out. A smaller mass makes a finer and thinner tube.

(*c*) The speed at which the two men walk away from each other in stringing out the molten mass. If they walk rapidly the tube will be smaller and thinner.

As large beads are made in precisely the same way as small ones the diameter of the beads will depend entirely on these three things, and especially on the last two, for out of the same fondant tubes of all sizes can be made. These tubes are, when cold, cut or broken into lengths of about 1 yard. These lengths are called "canne" (canes or reeds) and resemble straws or bamboo rods without joints; and these canne are the material out of which the beads are made. In similar fashion rods that are not hollow canes can be made by merely omitting to make the cup in the fondant.

6. The canes are sorted into sheaves of the same size. This work is done by women and often by quite young girls, who work by the sense of touch, rapidly dividing canes that are apparently all of the same diameter into different groups between the fingers.

7. The sheaves are then taken to the clipping machines, which resemble little guillotines. On a flat trough the canes, placed side by side, pass automatically (but guided by hand) under the little guillotine blade that, by the revolution of an electrically driven wheel, clips the canes into bits by biting off the ends. The length of these bits is about equal to the diameter of the cane. These clipped cross sections have sharp edges. The powdered glass produced by the clipping is sifted and fanned out, and the raw-edged beads are ready for rounding and finishing.

ROUNDING THE BEADS—SORTING FOR SIZE AND PERFORATION

8. The holes in the raw beads are filled with a composition of charcoal and ordinary lime, after which the beads are intermixed in four or five times their weight of ordinary beach sand from the Adriatic, and the sand and stuffed beads are put into an egg-shaped, covered crucible that revolves on an axis, tilted at about the same angle of inclination as the globe. This crucible revolves in the heart of a gas-fed furnace at about 400° of heat. The charcoal is consumed, the lime vanishes after having served to "fix" the aperture, the edges of the beads become smooth and rounded, the sand grinds

and polishes them and at the same time keeps them from coalescing with each other, and, finally, sand and beads together are dumped out into large shallow pans to cool.

9. When cold the sand is sifted and fanned away in a series of large, covered, wooden ventilators, and the beads, clean and polished, pass through a funnel or hopper into a series of rocking cradles placed one above the other in a series of eight. The floors of these cradles are sieves with graduated orifices or mesh bottoms, and from these cradles the beads, neatly assorted as to size, pass through little hoppers into baskets set to receive them. Beads of the same color but of many different sizes are thus automatically assorted as to size. (Assortment as to color is first made by hand while the beads are still in the cane.)

10. For the smaller varieties of beads still another sorting is necessary to determine if the holes have been perfectly preserved. For this purpose a cylinder about 15 inches in diameter, covered with thin wire filaments (like a wire brush), revolves over a tray of beads, and the filaments catch the beads that have holes in them, lifting them over, on the principle of a water wheel scooping up water, and dropping them on the other side through a hopper into a box. The bead is now complete, sorted as to color, tested as to size, tested as to perforation, associated with its fellows and equals, and ready for stringing or for shipping unstrung. This completes the necessary processes for making one-color beads.

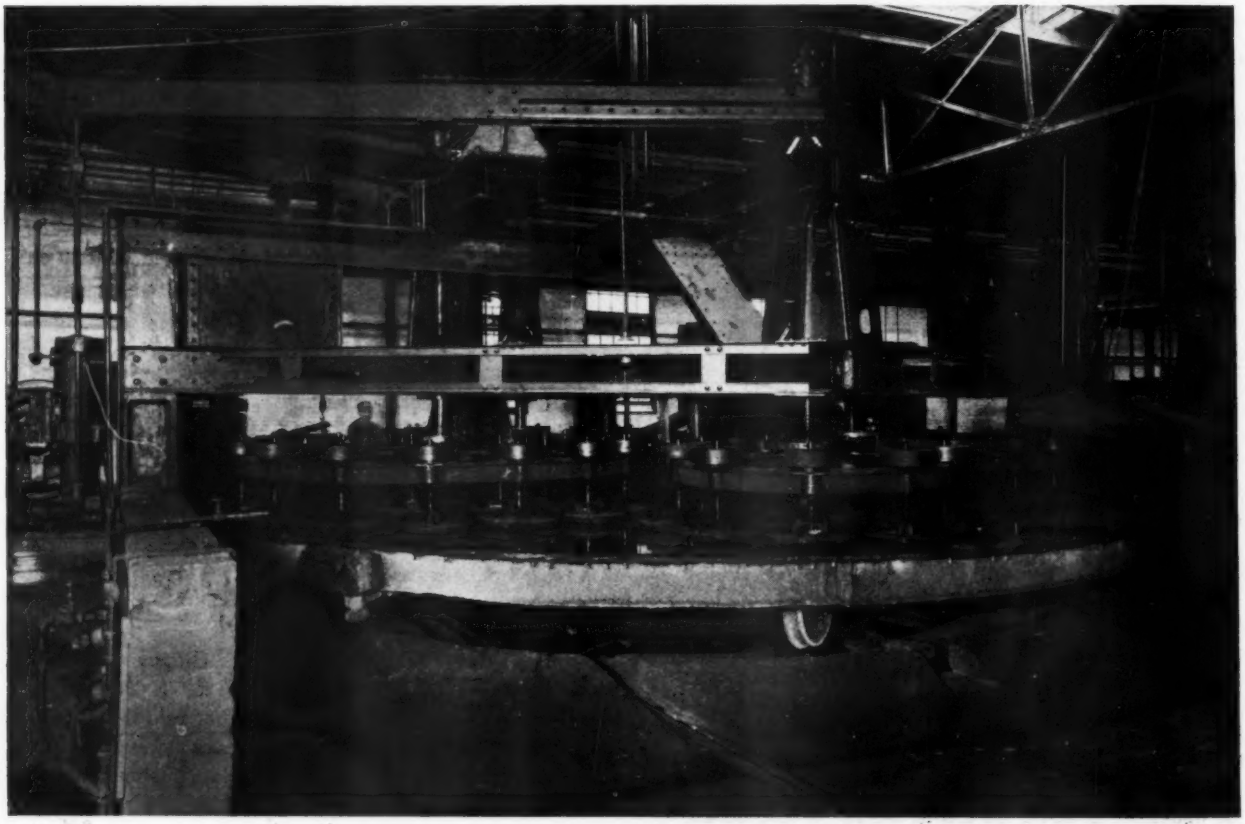
INVENTION OF MACHINE FOR TESTING PERFORATION

The necessity of a machine to sort the beads for perforation to detect and discard the imperfectly perforated beads was very great. In 1894 it was possible to make the ordinary small beads for about 70 centesimi per kilo (100 centesimi = 1 lira; kilo = 2.2046 pounds). The threading was done by women, as at present, using a handful of needles (24 to 30) at a time and threading very rapidly. For the very small beads the string was about 10 inches long and for the larger beads about 18 inches long. A bundle consisted then of 480 strings, and a good worker could string 10 bundles per day at 12 centesimi per bundle.

Modern Methods of Making Plate Glass Illustrated

A Series of Interior Views of a Successful Factory

By Courtesy of Allegheny Plate Glass Company, Glassmere, Pennsylvania



11. The Final Polish. After going through the various processes illustrated in previous issues, from the mixing of the batch to the grinding operations described in the August number, the final gloss is given to the finely ground surface of the glass plate by a polishing machine consisting of a large number of revolving felt blocks, resting on the glass on the turning deck. Liquid rouge is fed on to the glass at the center of the table and the felt blocks, with a double revolving motion of great rapidity, impelled by the friction of the moving glass, gives the desired finish in one hour and forty minutes. After a careful inspection, the deck goes to the stripping yard, the plates and deck are cleaned and the glass turned over and made ready for grinding the reverse side. The whole process, as illustrated in this series, is then repeated. After completion, the plates are removed by cranes to the wash racks, then to the inspector's set-up stand, and from there to the cutting, sorting and storage warerooms.

There was a constant controversy between the women and the companies because out of every 100 kilos the women used to bring back 20 kilos, or one-fifth, claiming that they could not be strung—meaning that they could not be strung rapidly as the orifices were small or faulty, and as the woman worked by the piece they interfered with her speed and diminished her pay. Only about 5 per cent, or 5 kilos out of 100, were totally lacking in perforation. So the makers had a grievance as well as the women, as such beads had to be remelted and remade and for this purpose had a value of only 5 centesimi per kilo, and the makers were losing about 9 lire per 100 kilos on 15 kilos of beads that could have been strung but not rapidly.

Cavaliere Salvatore Arbib, one of the manufacturers, conceived the idea of the sorting drum with the wire teeth, and the machine, called a "tamburo," was made by Meyer & Sons, of Birmingham, England. The teeth or threads of the sorting machines may be of various diameters, so that the beads rejected by a coarse-toothed machine may be picked up by a finer toothed tamburo. This machine was perfected in 1894. The first threading machine to thread the beads on fine wire was made by the same firm in the same year for the same man. The total cost of the experiments and the making of the two machines was about £5,000 sterling.

"LUCIDATION"—MECHANICAL AND HAND STRINGING

To return to the processes:

11. Certain one-color beads for America have the surfaces slightly ground by contact with emery paste or other grinding material or even sawdust. This process takes place outside the Murano factory and usually in Venice. It is called lucidation.

12. Certain beads are then strung by special machinery on thin wire filaments. The wires are suspended in brass tubes and the projecting curved end of the wire picks up beads from a revolving basin which forces them against the end of the wire. These wire-strung beads are mostly exported to France for use in making the coarser grades of artificial flowers for funeral wreaths.

13. All small beads are ordinarily strung by hand. This is done in Venice by cottage labor of women and girls. It is not an unusual sight in the Castello section of Venice to see a group of women and girls sitting in the streets, each with a pan of beads in her lap, threading and gossiping at the same time. The needles are about the length of knitting needles, but much smaller in diameter, with an eye for the thread at the lower end like an ordinary hand sewing needle. The worker takes a number of these needles and spreads them out like a fan or the tail of a peacock, holding them thus grouped in one hand and thrusting the ends into the pan of loose beads until they are covered for almost their full length, when the beads are slipped down on the threads and the needles are again arranged to pick up more beads. A good worker can operate 24 needles at a time, and some of the women boast that they can operate 48 needles at once.

"COUNT" AND "POUND" BEADS—MULTICOLORED BEADS

14. The strands of beads are sometimes bunched by the women who thread them and sometimes by girls at the Murano factory. Some classes of beads are bunched for weight and others for number. Many of the small beads are sold by number. Such beads are sometimes referred to as "count beads," while those sold by weight are known to the English trade as "pound beads." The bunched beads are sorted for size and color and in some cases according to country of destination and are stacked in shelf bins in the warehouse according to a chromatic scale. To look at the side of the warehouse is like looking at a rainbow where the shades insensibly melt into each other.

15. The bunches of loosely strung beads are usually packed for shipment in small packages (1 pound or 1 kilo) wrapped in manila paper. The label shows catalogue or list-card classification of the merchandise and also bears the name of the purchaser (printed) when the purchaser is a regular client and buys in large quantities.

Even the smallest beads may be made in more than one color and can, in fact, be made in a great variety of colors and patterns. The process is identically the same as for making one-color beads except that a distinct fondant must be made for each shade of color. Out of the base fondant is made the cup as described in No. 3 above. The fondants of the other colors are superimposed on this to make the pattern, reheating the cup as often as necessary but never allowing it to lose its cup form. When all the colors are superimposed it is reheated almost to the point of liquefaction and then pulled into the tube as already described. The ductility of the medium causes the pattern (as is the case with the orifice) to be preserved, even though the tube be pulled out to the diameter of a needle. The different shades of fondant may be applied in complete coatings, like insulations on a wire, or in stripes applied to the base fondant, much as a candy maker adds his stripes of peppermint and wintergreen in making stick candy.

(*To be continued*)

Manganese in Glass Making

Practically all the raw materials used in glass contain some iron, usually in the form of ferric oxide. The iron, when present even in small quantity, imparts to the glass a pale green color that increases rapidly in intensity as the iron content increases. If a colorless glass is desired, this green color must be removed by some decolorizer. When considered from many angles, manganese probably is one of the best decolorizers that can be used in the making of pot glass. For with this decolorizer, nitre can be used freely which in turn allows quick fining of the glass. The quantity of manganese used varies considerably, depending on the character of the glass, the method of its manufacture, the iron contents of the raw materials, and the character or strength of the manganese used. Every manufacturer has his own ideas on this subject. The quantity used is figured in terms of pounds of manganese dioxide per thousand pounds sand batch. The temperature employed in the glass making process helps to determine the quantity of manganese dioxide used, for the higher the temperature the more manganese is necessary. The maximum limit is usually 10 to 15 pounds of manganese dioxide per 1,000 pounds of sand, and the minimum 2 to 2½ pounds.—*"Double-S Fax," published by The Sharp-Schurtz Company.*

The Laboratory

By J. B. KRAK

Gaseous Fuels—II

PRODUCER GAS

The primary requisite for the utilization of solid fuels is their conversion into gas. On the method of gasification and on the nature of the solid fuel depends whether the gases formed by the conversion are combustible or not.

In grate or direct firing complete combustion is effected in proximity to the fuel bed. The fuel is gasified and completely burned within the same chamber. This method of heating, which of course is the usual one in most industries, has been largely abandoned in glass manufacturing since it is uneconomical and because the products of combustion and ashes are likely to contaminate the glass. However, that glass of high quality can be made by direct firing is abundantly illustrated by the many pieces of beautiful glassware made in the past under conditions which at the present time seem almost unbelievable.

The gas producer provides a means of separating the gasification and the combustion and has created the possibility of obtaining very high temperatures through combustion under conditions favoring the fullest realization of the heat value present in the fuel.

The gas producer is not a means to produce a greater amount of heat than can be obtained by direct firing. Even with the greatest possible utilization of the sensible heat of the gas through a close connection of the producer to the furnace there is a heat loss, due to radiation. But in spite of unavoidable losses, the gas producer makes it possible to obtain very high temperatures and accomplishes better results than grate firing, since the combustion takes place in close contact with the substances to be heated, a condition which, in the glass industry, cannot be attained by direct firing.

Producer gas may be defined as the product of the partial combustion of fuel in a gas producer, by drawing air and steam by natural or forced draft or by means of a blower, through a fuel bed contained in a steel shell, lined with refractory brick.

The chemical reactions involved in the making of producer gas and the thermal relations existing are, as a rule, less well understood than the mechanical principles of the gas producer. Yet it is essential that the fundamentals which underlie the process shall be clearly grasped by those in charge of operations if the best results are to be obtained. In the following outline the quantities of heat given in each equation are obtained on the assumption that one pound of carbon enters into reaction, instead of stating the heat produced on the molecular weight basis, which would be 12 pounds of carbon. The algebraic signs preceding the quantity of heat state whether heat is formed (plus sign) or absorbed (minus sign).

REACTIONS TAKING PLACE IN THE PRODUCER

The first reaction which takes place in the producer is probably the formation of carbon dioxide from the carbon in the fuel and the oxygen of the air, as follows:

$$\underset{\text{carbon}}{C_2} + \underset{\text{oxygen}}{2O_2} = \underset{\substack{\text{carbon}\\\text{dioxide}}}{2CO_2} + 14{,}540 \text{ B. t. u.} \quad (1)$$

The heat liberated by the reaction renders the fuel incandescent so that with steam the following reaction takes place:

$$\underset{\text{carbon}}{C_2} + \underset{\substack{\text{water}\\\text{(steam)}}}{4H_2O} = \underset{\substack{\text{carbon}\\\text{dioxide}}}{2CO_2} + \underset{\text{hydrogen}}{4H_2} - 2{,}848 \text{ B. t. u.} \quad (2)$$

The carbon dioxide, formed originally (reaction 1) is reduced to carbon monoxide on coming in contact with incandescent coal:

$$\underset{\substack{\text{carbon}\\\text{dioxide}}}{2CO_2} + \underset{\text{carbon}}{C_2} = \underset{\substack{\text{carbon}\\\text{monoxide}}}{4CO} - 5{,}780 \text{ B. t. u.} \quad (3)$$

Reactions (2) and (3) absorb heat and require a temperature of about 1,500° F.

A combination of the reactions expressed by equations (1) and (3) result in the formation of carbon monoxide. By addition we have:

$$C_2 + O_2 = 2CO + 4{,}380 \text{ B. t. u.} \quad (4)$$

Similarly (2) and (3) give:

$$C_2 + 2H_2O = 2CO + 2H_2 - 4{,}316 \text{ B. t. u.} \quad (5)$$

If there were no heat losses, the ideal producer gas process would be a combination of reaction (4) and (5), which may be written:

$$2C_2 + O_2 + 2H_2O = 4CO + 2H_2 + 64 \text{ B. t. u.} \quad (6)$$

However, since the oxygen in reaction (4) is obtained from air containing 79 per cent nitrogen[1] it is associated with $\frac{79}{21}$ or 3.76 times its volume of inert gas, which appears on both sides of equation (6).

In practice a large part of the heat developed in reaction (4) is lost, therefore in order to maintain the necessary high temperature required for the reaction, the heat producing reaction (4) must occur in larger proportion than the heat consuming reaction (5); in other words, there must be a proper proportion between the air supply and the amount of steam injected, or the temperature will drop below that at which chemical reactions can take place.

It is evident that while the use of steam does not add to the calorific power of the fuel, it is a means to convert sensible heat, which cannot be utilized to good advantage, into chemical energy. This energy, in the form of free hydrogen is then available in the combustion chamber. Another advantage of the application of steam is the prevention of excessive heat in the fuel bed, which would result if air alone were used. The greater the quantity of steam used, the less the proportion of nitrogen in the gas, the higher the

[1] Dry air has the following composition by volume: Nitrogen 78.2 per cent, oxygen 20.9 per cent, argon 0.9 per cent and small amounts of carbon dioxide and ammonia.

calorific power per cubic foot, and the lower the temperature of the exit gas, resulting in less radiation loss of sensible heat. Experience has shown that there is a definite limitation to the amount of steam which can be decomposed, as is shown by the following table[2]:

EFFECTS OF TEMPERATURE ON ACTION OF STEAM

Temperature, degrees C.	Percentage of steam decomposed.	Composition of gas by volume.		
		H	CO	CO_2
674	8.8	65.2	4.9	29.8
758	25.3	65.2	7.8	27.0
838	41.0	61.9	15.1	22.9
954	70.2	53.3	39.3	6.8
1010	94.0	48.8	49.7	1.5
1125	99.4	50.9	48.5	0.6

An excessive use of steam results in a decrease of the heating value of gas, since it appears as water vapor thereby increasing the percentage of inert gas.

The most economical proportion of steam and air depends on many factors such as the temperature of both steam and air, the nature of the fuel, and the type and condition of the gas producer. In average practice for every five pounds of carbon consumed, four are burned by air and one by steam.

EFFECT OF CARBON DIOXIDE

Equation (4) represents an ideal condition. In practice part of the carbon dioxide remains without being reduced to carbon monoxide. When over 5 per cent is present in the producer gas it is an indication of careless operation or faulty construction of the producer. It requires more air to form carbon dioxide and consequently the amount of inert nitrogen is thereby also increased. The following table[3] shows the influence of temperature on the conversion of carbon dioxide to carbon monoxide:

Temperature, degrees C.	Carbon dioxide converted per cent by volume.
900	1.4
950	8.3
1000	33.3
1050	73.4
1100	91.3

The table shows that it is impossible to reduce the proportion of carbon dioxide below a definite percentage, depending on the temperature. It is probable that carbon monoxide is changed to carbon dioxide and carbon after the gases have left the fuel bed in consequence of the reaction:

$$2CO = CO_2 + C$$

which may to some extent explain the deposition of soot in the pipes of gas producers.

GAS PRODUCER EFFICIENCY

A heat balance for a gas producer may be established by accounting for all the heat supplied and for all the heat which reappears. The difference may be assumed to be the loss due to radiation, conduction, etc. The efficiency depends on the manner in which the chemical reactions in the process take place. The gas leaving the producer carries two sorts of heat, that present as chemical energy and that due to its temperature, designated as sensible heat. The sum of the two is called useful effect. Efficiency is the quotient of the useful effect and heat supplied to the producer; in other words, efficiency is equal to output divided by input:

$$E = \frac{H'}{H}$$

In order to calculate the efficiency, analyses of the gas and the coal must be made. The amount of carbon lost in the ashes must be determined and the temperature of the gas measured. The weight of the carbon in the ash divided by the weight of the coal burnt during the same period gives the proportion of carbon lost in the ashes.

If the combustible matter in coal were all carbon the percentage lost in the ashes would be computed from the formula:

$$\frac{100\ A\ P}{(100-P)\quad(100-A)}$$

in which A = per cent of ash in the coal, and P the per cent of carbon in the ash. This formula is sufficiently accurate when coke or anthracite is used, but for bituminous coal, which may have from 30 to 40 per cent volatile matter, another factor must be introduced to render the formula applicable, viz.:

$$\frac{\text{Calorific value of 1 lb. carbon}}{\text{Calorific value of 1 lb. combustible.}}$$

The heat value of the volatile matter is to that of carbon as 14:10, therefore the factor becomes:

$$\frac{10\ (100-A)}{10\ (100-A)+4V}$$

in which V = per cent of volatile matter in coal. The combined formula for bituminous coal is therefore:

$$\text{Per cent loss in ash} = \frac{1000\ A\ P}{(100-P)\quad(1000-10A+4V)}$$

The Figure of Merit[4] compares the performances of various producers or the same producer under different conditions. It represents the heat value of the gas produced per unit weight of carbon it contains and is computed by dividing the heat value per standard cubic foot of gas by the weight of carbon the standard foot contains. Wyer[5] gives the following computation as an example:

Component of gas by volume.		Heat value in B. t. u. per cu. ft.	Pounds carbon in gas.
CO_2	4.0%	0.0	.00134
CO	25.4%	86.86	.00748
CH_4	1.5%	16.05	.00505
H_2	11.1%	38.40	.01387
N_2	58.0%	0.0	
		Heat value, 141.31	

$$\text{Figure of Merit } \frac{141.31}{.01387} = 10{,}187 \text{ B.t.u. per lb. of carbon}$$

in the gas.

[2] Robinson, Gas and Petroleum Engines, p. 553.
[3] Transactions Chem. Soc., vol. 101, p. 831.
[4] Proc. Inst. Civil Eng., vol. 73, p. 328.
[5] Producer Gas and Gas Producers, p. 86.

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CLASSIFIED BUYERS' GUIDE, PAGE 14

"THE amazing accomplishments of the men of the industry who with unconquerable spirit and almost unbelievable ingenuity steadily surmounted the obstacles that confronted them, time and again 'accomplished the impossible,' and finally produced the marvelous inventions by which glass is automatically wrought into a thousand forms, prove to the world that in the American glass industry there is no such word as *can't*."

Lime in Glass Making

A booth at the recent Exposition of Chemical Industries which attracted many visitors was the exhibit of the National Lime Association. The object of the Association, which was organized in 1919, is "to promote the use of lime for all purposes to which it is suited and to develop such new uses as may be discovered practicable and the doing of all things incidental or conducive to the attainment of above objects." One of the features of the work of the Association is the spreading of knowledge among consumers of lime as to the best methods for its use. Through a staff of experts the Association has taken up research work with the purpose of finding new outlets for the products of its membership. At a recent special convention provision was made for increasing the facilities for the work of the Association.

Since the glass industry is a large consumer of lime, it may be expected that the use of lime as applied to glass manufacturing will receive a share of attention commensurate with its importance. It would be especially gratifying if an impartial survey could be made as to the views of glass makers throughout the country on the comparative advantages and disadvantages of the use of burnt lime as against limestone or marble, with reasons for their preference. It would be interesting to have a consensus of opinion as to how either form of lime affects the quality of the finished glass. Another question in which glass makers are concerned is to know the extent of the saving of fuel obtained by the use of burnt lime and the possibilities of increasing this saving by improvement in the efficiency of furnaces or by modifications in the methods of manufacture. These questions are of fundamental importance and at the present time there exists much difference of opinion as to their proper solution. They are subjects which grow in importance as the years pass and which deserve the concern of all forward-looking manufacturers.

Safety Campaigns

Results of organized safety work which are being reported throughout the country prove conclusively that many accidents are avoidable and can be prevented through education and propaganda. One of the most striking successes was the "Don't Get Hurt" campaign recently held in New York City. There was a great deal of scepticism manifested at the start, as it was felt that the incoherent mass of people of the metropolis could not be reached by a movement of this character. The results, however, have more than fulfilled the expectations of those responsible for the campaign. The first day showed a marked decrease in the number of fatal accidents which regularly occur, and throughout the week the number remained below the average established for several years past. In the light of this experience the splendid results of intensive campaigns for safety in factories are explainable.

The great difficulty with safety work appears to be to keep the interest alive of those who are to receive the benefit. If it is possible to have a month without an accident in a factory, it is worth while to create conditions which will stimulate everyone to keep up the high standard of safety

thus attained. This can only be done through active organization of the workers throughout the plant and by constantly keeping before their minds the advisability of taking no chances.

It is needless to emphasize the advantages that follow a permanent decrease in the number of accidents in industry. They are obvious, the greatest being the influence for better relations between employers and employees, which in more than one industrial enterprise has been the key to success.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions are invited to submit them.

Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question 36.—Heat Calculations.—Can you furnish me with the make-up of a typical window and plate glass batch, and the constants necessary in figuring the heat balance of the furnace, such as specific heat, heat of fusion, etc., for the principal ingredients of the common batches.

As yet I have been unable to find any reliable information on the method of computing the heat liberated by the formation of carbonates in the furnace, and for calculating the specific heat of the constituents of producer gas at high temperatures. There seems to be considerable difference of opinion among authorities on all of the above mentioned subjects.

Answer.—We submit the following calculations of the heat requirements of a plate glass batch having the composition Na_2O CaO6 SiO_2, or on a percentage basis, 75.3 SiO_2, 12.9 Na_2O, 11.8 CaO.

The specific heat of this glass can be calculated from the following formula:

$$C = \frac{a_1}{100} \times e_1 + \frac{a_2}{100} \times e_2 + \frac{a_3}{100} \times e_3 + \ldots\ldots \frac{a_n}{100} \times e_n$$

in which a is the percentage of the component and e the corresponding specific heat. In the above example we have at zero degrees C:

$$C_o = \frac{75.3 \times 0.1913}{100} + \frac{12.9 \times 0.2674}{100} + \frac{11.8 \times .1903}{100} = 0.2009987$$

At a temperature t the specific heat is calculated from the formula $Ct = C_o (1 + \alpha t)$. The average specific heat between the temperatures o and t is calculated from the formula:

$$Cmt = C_o \left(1 + \frac{\alpha t}{2}\right) \text{ in which } \alpha = .00078, \text{ therefore}$$

$$Cmt = 0.20 \left(1 + \frac{.00078t}{2}\right).$$

Supposing the furnace temperature to be 1500° C. we have: $Cmt = 0.20 (1 + .00039 \times 1500) = 0.314$, which is the average specific heat of this glass between zero and 1500° C.

One kilogram of calcium silicate requires 27.3 calories, one kilogram of sodium silicate requires 30 calories, therefore in order to produce one kilogram of glass there are needed:

1.	For heating from O° to 1500° C. $1500 \times 0.314 =$	471.0 calories
2.	For heat of reaction $Na_2O + CaO + 2\ SiO_2$, $27.3 + 30 \ldots\ldots =$	57.3 "
3.	Fusion of the excess $SiO_2 \ldots\ldots =$	30.0 "
	Total	558.3 calories

This problem can also be solved in a different manner giving a somewhat higher result.

In the following calculations we have to consider four items: viz.,

1° The heat required to bring the batch up to 1500° C.
2° The heat required to decompose carbonates.
3° The heat required for the fusion.
4° The heat liberated by the formation of silicates.

On the kilogram—molecular basis we have:

106 Na_2CO_3
100 $CaCO_3$
360 SiO_2

566 kilograms batch which give 478 kg. glass

The calculated average specific heats between 0° and 1500° C. of the batch ingredients are:

For Na_2CO_3: $0.273 (1 + 0.00039 \times 1500) = 0.273 \times 1.585 = 0.433$
" $CaCO_3$: $0.215 \times 1.585 = 0.341$
" SiO_2 : $0.1913 \times 1.585 = 0.302$

1. Heat required to bring the batch up to 1500° C.
   106 Na_2CO_3; $106 \times 1500 \times 0.433 =$ 68,847 calories
   100 $CaCO_3$; $100 \times 1500 \times 0.341 =$ 51,150 "
   360 SiO_2 ; $360 \times 1500 \times 0.302 =$ 163,080 "
   Total ..... 283,077 calories (1)
2. Heat required to decompose carbonates:
   Na_2CO_3; $106 \times 713.2 =$ 75,600
   $CaCO_3$; $100 \times 451.5 =$ 45,150
   Total ..... 120,750 calories (2)
3. Heat required for fusion:
   $478 \times 29.342 =$ 14,025 calories
   Total (1),(2) and (3) 417,852 calories (3)
4. Heat of formation of silicates:
   1 kg. — mol. Na_2SiO_3 65,000 calories
   1 kg. — mol. $CaSiO_3$ 35,000 "
   Total .....100,000 calories

The heat required is 417,852 — 100,000 = 317,852 calories or per kilogram $\frac{317852}{478} = 665$ calories.

The data are based on "Thomson" Thermochemische Untersuchungen. Similar data can be obtained from Richards' "Metallurgical Calculations."—J. B. K.

New Books

BURNING LIQUID FUEL. A Practical Treatise on the perfect Combustion of Oils and Tars, giving Analysis, Calorific Values and Heating Temperatures of Various Gravities with Information on the Design and Proper Installation of Equipment for all Classes of Service, by William Newton Best. Published by U. P. C. Book Company, Inc., New York. Size 9¼ x 6 inches. 336 pages. Price $5.00.

Among the numerous books on fuels published during the past few years, this volume, written by one of the well known experts on combustion engineering, deserves especial mention. The author has succeeded in describing with great clearness a number of typical examples of the various ways in which liquid fuel can be utilized in different industries. The chapter devoted to Glass Industry Equipment is interesting and instructive. The style is pleasing and direct, and the language used will be readily understood by all classes of readers. The volume is profusely illustrated. Whatever change and improvement the future may bring to this subject, with all its possibilities for growth, no one is likely to regret the acquisition of this valuable book.

THE POTTER'S CRAFT. A Practical Guide for the Studio and Workshop, by Charles F. Binns, Director of the New York State School of Clay Working and Ceramics, Second Edition, Revised and Enlarged. Published by D. Van Nostrand Company, New York. Size 7½ x 5 inches, 200 pages. Price $2.50 net.

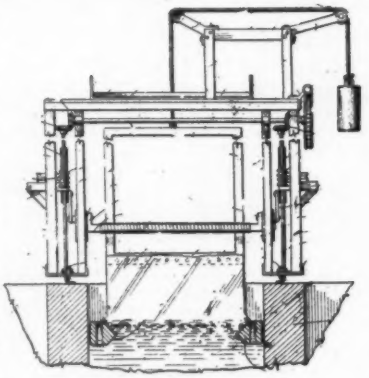
The first edition of this book appeared in 1911. To the new edition some new chapters have been added. The volume is written especially for students who desire to become individual artist-potters, and is the result of many years of experience of the author as superintendent in the Royal Porcelain Works, Worcester, England, as artist and as teacher in the New York State School of Clay Working and Ceramics. The author presents a simple and yet detailed account of his subject. Definite and concise instructions are given regarding the preparation of clay, mold making and concerning the different manipulations required in the making of various kinds of pottery. The chapters on glazes and glazing are especially interesting. The book will prove stimulating and instructive to anyone who wishes to study the potter's craft.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

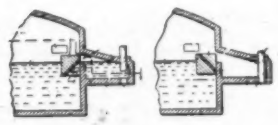
Copies of the Patent Specifications mentioned below may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c. each.

Sheet Glass Drawing Machine. U. S. 1,423,195. July 18, 1922. Ora M. Cox, of Manayka, and Connie C. Rose, of Clarksburg, W. Va.



This invention relates to sheet glass drawing machines, and the primary object of the invention is to provide an improved machine for continuously drawing sheet glass, and thereby eliminate the necessity of intermittently raising and lowering the bait for drawing the glass from the molten glass container or pot.

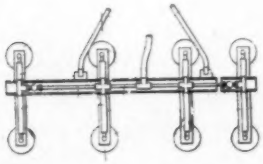
Means for Controlling Discharge from Glass Tanks. U. S. 1,423,220. July 18, 1922. Edward S. Hutton, of Lapel, Indiana.



The object of this invention is to provide a satisfactory means for shutting off the flow of glass from a glass tank in a glass factory to the spout or discharge chamber thereof, when the tank is not being used or operated temporarily during Sundays or any temporary shutdown, and thereby prevent the glass chilling in the discharge spout or outlet and requiring the removal of the chilled glass.

The chief feature of the invention consists in providing a floater block inside of the glass tank adapted to extend across the outlet to the spout and close the flow of glass thereto, when the block is in one position, but permits the flow of glass thereto when the block is in another position. The operator determines the position of the block. With this arrangement the channel in the discharge spout will be entirely drained and said channel and the outlet opening therefrom will be free from chilled glass. Therefore, on the resumption of operation, all that is necessary is to adjust the floater block and the fresh hot glass immediately flows into the discharge spout and out of it through the discharge outlet.

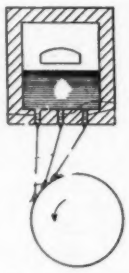
Apparatus for Holding and Lifting By Means of Suckers. U. S. 1,426,692. August 22, 1922. Frederic Barnes Waldron, of Prescot, England, assignor to Pilkington Brothers Limited, of St. Helens, England.



This invention relates to apparatus for holding and lifting by means of suckers.

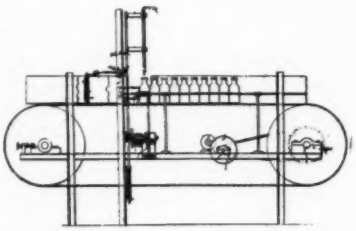
It is more especially designed for lifting plates of glass in the course of their manufacture, in which they are bedded on to the grinding and polishing tables and have to be lifted therefrom. The plates when so bedded, adhere so firmly to the tables that it is impracticable, unless by the use of very powerful apparatus, to lift them by a direct vertical pull, and when being lifted by hand, they have to be raised first at one edge and, as it were, peeled off the table, the flexibility of the plates permitting this peeling action. The lifting apparatus which forms the subject of this invention, imitates this action of lifting by hand, and, under the hoisting action of the crane, lifts the plate first at one edge and, by allowing it to bend, peels it off the table.

Apparatus for the Production of Spun Glass. U. S. 1,427,014. August 22, 1922. Gedeon von Pazsiczky, of Hamburg, Germany.



In this invention the molten glass rests stationary and the drop separating from the mass of glass which draws a thread drops in free fall without any additional movement upon the moving surface upon which it sticks while the spinning of the thread continues. The drop of glass can come from a glass rod, a glass tube or from any other piece of glass or even from a melting furnace. For the further drawing off of the glass drop or of the glass thread and for the piling up of this glass thread a device of any convenient construction to be operated by hand or mechanically can be used. A device specially adapted for this purpose consists of a revoluble drum or cylinder to which the glass drop adheres so that the glass thread which comes after the drop will be wound around the drum or cylinder or will be piled up on the same.

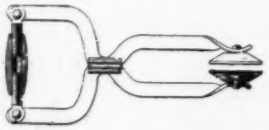
Apparatus for Testing Glass Containers. U. S. 1,427,817. September 5, 1922. Oliver C. K. Hutchinson, of Alton, Ill., assignor to Illinois Glass Company, of Alton, Ill.



The invention comprises an apparatus adapted to automatically handle the containers to be tested, thereby avoiding the expense of a visual inspection of each individual container. Furthermore, it is claimed, the testing device will detect minute defects which have heretofore escaped the observation of an inspector.

Briefly stated, the preferred form of the invention includes a spark producing device whereby an electrical spark is projected through the defects in the glass containers, so as to select the defective containers from the others. One of the sparking electrodes of an electrical sparking device is preferably located outside of and adjacent to the glass container, and the other electrode is preferably located within the container. When the electrodes are thus associated with a defective bottle, the spark tending to jump from one electrode to the other will be projected through the defect, thereby enabling the defective bottle to be distinguished from a perfect bottle. If there is no defect in the bottle, the glass being an insulator will prevent the discharge of a spark between the electrodes.

Glass Tongs. U. S. 1,428,679. September 12, 1922. Carl F. Caswell, Coon Rapids, Iowa.



It is the purpose of the present invention to provide a simple, durable and inexpensive device adapted to securely grip plates of glass or like objects and furnish means for conveniently carrying the same.

A further object is to provide a gripping device of this kind having a handle by which the same may be grasped, said handle being also adapted to clamp and lock the grips against an object.

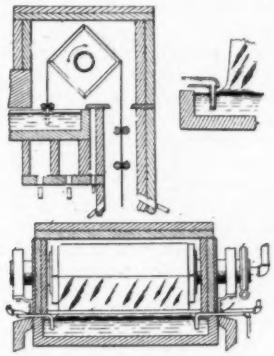
A further object is to furnish in a device of this nature, a rest adapted to bear against the object to be moved and to steady the device with respect to said object.

In use the tongs are applied to the margin of a glass plate. To prevent the levers from coming into contact with the glass at the point of connection between said levers, a cushioned rest is supplied which bears against the edge of the glass. In one form, this rest comprises a holder having ears connected by a bolt to the projection on the pintle, said holder containing a cushion of soft wood, rubber, cork or other suitable material, having an elongated recess to receive the margin of a plate of glass. This recess is V shaped in cross section to accommodate glass of different thicknesses.

Glass Cutter. U. S. 1,427,052. August 22, 1922. Arthur A. Arnold, of Southbridge, Mass., assignor to American Optical Company, of Southbridge, Mass.

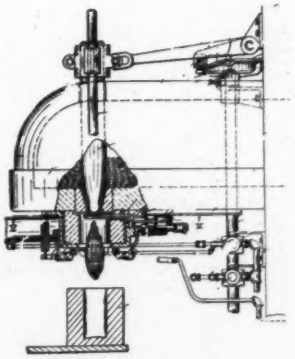
This invention relates to new and useful improvements in glass cutters and more particularly to an improved machine adapted for use in cutting glass into ellipses and other irregular shapes, especially ophthalmic lenses.

Apparatus for and Method of Drawing Sheet Glass. U. S. 1,428,533. September 12, 1922. Joseph P. Crowley, of Toledo, Ohio, assignor to the Libbey-Owens Sheet Glass Company, of Toledo, Ohio, a Corporation of Ohio.



The inventor claims in a continuous sheet glass drawing apparatus, a rotary device having a circumferential series of plane surfaces for engaging the sheet and changing its direction of travel, and for simultaneously flattening the sheet into a series of connected flat sections and changing its direction of travel, said device having a series of plane sheet engaging faces, the edges formed by the intersecting plane surfaces serving as sheet gripping means, thus relieving the flattened portions of the sheet from undue strain; and means for internally cooling said flat surfaces and for swinging the successive sections through an angle of approximately 180°, and then passing the sheet downwardly through suitable guides into an annealing chamber.

Apparatus for and Method of Producing Charges of Molten Glass. U. S. 1,428,994. September 12, 1922. Leonard D. Soubier, of Toledo, O., assignor to the Owens Bottle Company, of Toledo, O.

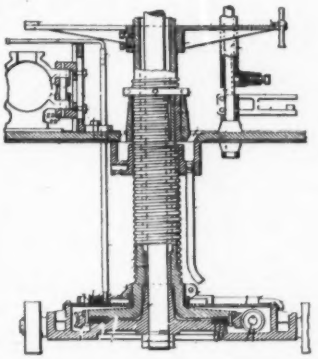


This invention relates to a method and apparatus for producing formed charges of molten glass to be delivered to the molds of a glass forming machine. The invention is of special value for the production of charges or gobs of glass of a size and shape suited for the formation of battery jars, large bottles and various other lines of ware which require charges containing a considerable quantity of glass.

An object of the present invention is to provide practical means for producing a formed charge containing a comparatively large quantity of glass but having a small cross sectional area and of suitable shape for entering the mold, and also to rapidly form such a charge, whereby the time interval between the delivery of successive charges is reduced, as may be required for example, to feed large machines of the continuously rotating type.

A further feature of the invention consists in the provision of means whereby the same apparatus may be used in the production of small globular shaped charges of glass for use in making such articles as fruit jar covers, etc.

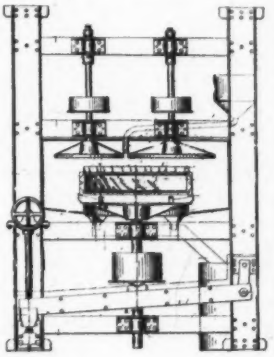
Apparatus for Manufacturing Glass Articles. U. S. 1,428,855. September 12, 1922. William J. Miller, of Swissvale Borough, Pa.



This invention consists in certain new and useful improvements in machines for manufacturing articles of glassware, and it more especially is intended to be applied to paste mold machines.

The improvements consist in a new mounting for the molds and means for closing and opening the same; the improved means for mounting, rotating and supplying compressed air to the blow pipes, and in improved means for cooling the open molds.

Glass-Grinding Machine. U. S. 1,430,879. October 3, 1922. Harry M. Barbeau, of Toledo, O., assignor to the Willys-Overland Company, of Toledo, O.



The present invention relates to a glass grinding machine and has for an object, among others, to provide an improved construction preferably for simultaneously grinding a plurality of glass sheets down to a uniform desired size, the invention having particular utility, although not limited thereto, with the production of glass sheets for windshields for automobiles. The invention contemplates broadly the provision of a mechanism operative to grind glass sheets to size performing an operation heretofore done, in certain instances, by hand, and to provide a machine which is simple to construct, easily operated, and efficient in such operation.

Process of and Mixture for Making Glass. U. S. 1,430,725. October 3, 1922. A. L. Duval d' Adrian, of Washington, Pa.

The inventor claims to have found that the greenish color imparted by iron can be wholly or partly eliminated by the addition to the usual glass mixture of a compound of bromine, such as a bromine salt, capable of acting as an oxidizing agent at the high temperature at which the glass mixture is heated to melt. Such bromine compounds or salts may be magnesium bromide, sodium bromate, etc.

As a specific illustration of the ingredients employed in producing this improved glass, the following may be given.

Sand	1,000 lbs.
Soda ash	360 to 380 lbs.
Limestone	200 to 220 lbs.
Magnesium bromide	½ to 50 lbs.

The above ingredients are of course thoroughly mixed and heated in the usual manner so that the mass fuses, to produce the glass. On raising the mixture to the temperature of fusing, the magnesium bromide partially changes the iron present in the mixture to iron bromide. This iron bromide is volatile at the temperature of the fusion, and passes away from the mixture in the form of a gas. The magnesium bromide also partially oxidizes a portion or the remaining portion of the iron present, and this oxidized iron does not impart a greenish color to the glass.

The amount of bromine compound or bromine salt employed is varied materially depending upon the nature of the bromide compound used, and the condition of the glass-forming materials, to the results desired. Satisfactory results have been obtained by employing from one-half to fifty pounds of magnesium bromide, or sodium bromate, in combination with the other ingredients above stated.

The Tariff Law of 1922

Items Relating to Glass, Glassware and Glass Makers' Materials Abstracted from the Official Text

SCHEDULE 1.—CHEMICALS, OILS, AND PAINTS

PAR. 1. Boric acid, 1½ cents per pound.

PAR. 6. Aluminum hydroxide, ½ of one cent per pound.

PAR. 8. Antimony: Oxide, 2 cents per pound.

PAR. 12. Barium carbonate, precipitated, 1 cent per pound; barium chloride, 1¼ cents per pound; barium dioxide, 4 cents per pound; barium hydroxide, 1¼ cents per pound; and barium nitrate, 2 cents per pound.

PAR. 29. Cobalt: Oxide, 20 cents per pound.

PAR. 51. Manganese: Borate, resinate, sulphate, and other manganese compounds and salts, not specially provided for, 25 per centum ad valorem.

PAR. 72. Chrome yellow, chrome green, and other colors containing chromium, in pulp, dry, or ground in or mixed with oil or water, 25 per centum ad valorem.

PAR. 74. Lead pigments: Litharge, 2½ cents per pound; orange mineral, 3 cents per pound; red lead, 2¾ cents per pound.

PAR. 79. Zinc oxide and leaded zinc oxides containing not more than 25 per centum of lead, in any form of dry powder, 1¾ cents per pound.

PAR. 80. Potassium carbonate, three-fourths of 1 cent per pound; hydroxide or caustic potash, 1 cent per pound; nitrate or saltpeter, refined, one-half of 1 cent per pound.

PAR. 83. Sodium, borate or borax, refined, one-eighth of 1 cent per pound; carbonate, calcined, or soda ash, hydrated or sal soda, and monohydrated, one-fourth of 1 cent per pound; nitrate, salt cake (see free list).

SCHEDULE 2.—EARTHS, EARTHENWARE AND GLASSWARE

PAR. 203. Limestone (not suitable for use as monumental or building stone), crude, or crushed but not pulverized, 5 cents per one hundred pounds; lime, not specially provided for, 10 cents per one hundred pounds, including the weight of the container; hydrated lime, 12 cents per one hundred pounds, including the weight of the container.

PAR. 205. Plaster rock or gypsum, ground or calcined, $1.40 per ton.

PAR. 206. Pumice stone, unmanufactured, valued at $15 or less per ton, one-tenth of 1 cent per pound; valued at more than $15 per ton, one-fourth of 1 cent per pound; wholly or partly manufactured, fifty-five one-hundreths of 1 cent per pound; manufactures of pumice stone, or of which pumice stone is the component material of chief value, not specially provided for, 35 per centum ad valorem.

PAR. 207. Clays or earths, unwrought or unmanufactured, including common blue clay and Gross-Almerode glass pot clay, not specially provided for, $1 per ton; wrought or manufactured, not specially provided for, $2 per ton; china clay or kaolin, $2.50 per ton; bauxite, crude, not refined or otherwise advanced in condition in any manner, $1 per ton; fullers earth, unwrought and unmanufactured, $1.50 per ton; wrought or manufactured, $3.25 per ton; silica, crude, not specially provided for, $4 per ton; silica, suitable for use as a pigment, not specially provided for, $7.50 per ton; fluorspar, $5.60 per ton.

PAR. 217. Plain green or colored, molded or pressed, and flint, lime, or lead glass bottles, vials, jars, and covered or uncovered demijohns, and carboys, any of the foregoing, filled or unfilled, not specially provided for, and whether their contents be dutiable or free (except such as contain merchandise subject to an ad valorem rate of duty, or to a rate of duty based in whole or in part upon the value thereof, which shall be dutiable at the rate applicable to their contents), shall pay duty as follows: If holding more than one pint, 1 cent per pound; if holding not more than one pint and not less than one-fourth of a pint, 1½ cents per pound; if holding less than one-fourth of a pint, 50 cents per gross: *Provided*, That the terms "bottles," "vials," "jars," "demijohns," and "carboys," as used herein, shall be restricted to such articles when suitable for use and of the character ordinarily employed for the holding or transportation of merchandise, and not as appliances or implements in chemical or other operations, and shall not include bottles for table service and thermostatic bottles.

PAR. 218. Biological, chemical, metallurgical, pharmaceutical, and surgical articles and utensils of all kinds, including all scientific articles, utensils, tubing and rods, whether used for experimental purposes in hospitals, laboratories, schools or universities, colleges, or otherwise, all of the foregoing, finished or unfinished, composed wholly or in chief value of glass or paste, or a combination of glass and paste, 65 per centum ad valorem; illuminating articles of every description, including chimneys, globes, shades, and prisms, for use in connection with artificial illumination, all of the foregoing, finished or unfinished, composed wholly or in chief value of glass or paste, or a combination of glass and paste, 60 per centum ad valorem; all glassware commercially known as plated or cased glass, composed of two or more layers of clear, opaque, colored, or semitranslucent glass, or combinations of the same, 60 per centum ad valorem; table and kitchen articles and utensils, and all articles of every description not specially provided for, composed wholly or in chief value of glass or paste, or combinations of glass and paste, blown or partly blown in the mold or otherwise, or colored, cut, engraved, etched, frosted, gilded, ground (except such grinding as is necessary for fitting stoppers or for purposes other than ornamentation), painted, printed in any manner, sand-blasted, silvered, stained, or decorated or ornamented in any manner, whether filled or unfilled, or whether their contents be dutiable or free, 55 per centum ad valorem; table and kitchen articles and utensils, composed wholly or in chief value of glass or paste, or a combination of glass and paste, when pressed and unpolished, whether or not decorated or ornamented in any manner or ground (except such grinding as is necessary for fitting stoppers or for purposes other than ornamentation), whether filled or unfilled, or whether their contents be dutiable or free, 50 per centum ad valorem; *Provided*, That any of the articles specified in this paragraph, if containers of merchandise subject to an ad valorem rate of duty or to a rate of duty based in whole or in part upon the value thereof, shall be dutiable at the rate applicable to their contents, but not less than the rate provided for in this paragraph: *Provided further*, That for the purposes of this Act, bottles with cut-glass stoppers shall with their stoppers be deemed entireties.

PAR. 219. Cylinder, crown, and sheet glass, by whatever process made, and for whatever purpose used, unpolished, not exceeding one hundred and fifty square inches, 1¼ cents per pound; above that, and not exceeding three hundred and eighty-four square inches, 1⅜ cents per pound; above that, and not exceeding seven hundred and twenty square inches, 1⅝ cents per pound; above that, and not exceeding eight hundred and sixty-four square inches, 1¾ cents per pound; above that, and not exceeding one thousand two hundred square inches, 2 cents per pound; above that, and not exceeding two thousand four hundred square inches, 2¼ cents per pound; above that, 2½ cents per pound: *Provided*, That unpolished cylinder, crown, and sheet glass imported in boxes, shall contain fifty square feet, as nearly as sizes will permit, and the duty shall be computed thereon according to the actual weight of glass.

PAR. 220. Cylinder, crown, and sheet glass, by whatever process made, polished, not exceeding three hundred and eighty-four square inches, 4 cents per square foot; above that, and not exceeding seven hundred and twenty square inches, 6 cents per square foot; above that, and not exceeding one thousand four hundred and forty square inches, 12 cents per square foot; above that, 15 cents per square foot.

PAR. 221. Fluted, rolled, ribbed, or rough plate glass, or the same containing a wire netting within itself (not including crown, cylinder, or sheet glass), not exceeding three hundred and eighty-four square inches, three-fourths of 1 cent per square foot; all above that, 1½ cents per square foot; and all fluted, rolled, ribbed, or rough plate glass, weighing over one hundred pounds per one hundred square feet, shall pay an additional duty on the excess at the same rates herein imposed: *Provided*, That all of the above plate glass, when ground, smoothed, or otherwise obscured, shall be subject to the same rate of duty as cast polished plate glass unsilvered.

PAR. 222. Cast polished plate glass, finished or unfinished, and unsilvered, not exceeding three hundred and eighty-four square inches, 12½ cents per square foot; above that, and not exceeding seven hundred and twenty square inches, 15 cents per square foot; all above that, 17½ cents per square foot. Plate glass described in this paragraph containing a wire netting within itself, not exceeding three hundred and eighty-four square inches, 15 cents per square foot; above that, and not exceeding seven hundred and twenty square inches, 17½ cents per square foot; all above that, 20 cents per square foot.

PAR. 223. Cast polished plate glass, silvered, cylinder and crown glass, silvered, and looking-glass plates, exceeding in size one hundred and forty-four square inches and not exceeding three hundred and eighty-four square inches, 13½ cents per square foot; above that, and not exceeding seven hundred and twenty square inches, 16 cents per square foot; all above that, 21 cents per square foot: *Provided*, That none of the foregoing shall pay less duty than 35 per centum ad valorem: *Provided further*, That no looking-glass plates or glass, silvered, when framed, shall pay a less rate of duty than that imposed upon similar glass of like description not framed, but shall pay in addition thereto upon such frames the rate of duty applicable thereto when imported separate.

PAR. 224. Cast polished plate glass, silvered or unsilvered, and cylinder, crown, and sheet glass, by whatever process made, silvered or unsilvered, polished or unpolished, when bent, ground, obscured, frosted, sanded, enameled, beveled, etched, embossed, engraved, flashed, stained, colored, painted, ornamented, or decorated, shall be subject to a duty of 5 per centum ad valorem in addition to the rates otherwise chargeable thereon.

PAR. 225. Spectacles, eyeglasses, and goggles, and frames for the same, or parts thereof, finished or unfinished, valued at not over 65 cents per dozen, 20 cents per dozen and 15 per centum ad valorem; valued at over 65 cents per dozen and not over $2.50 per dozen, 60 cents per dozen and 20 per centum ad valorem; valued at over $2.50 per dozen, 40 per centum ad valorem.

PAR. 226. Lenses of glass or pebble, molded or pressed, or ground and polished to a spherical, cylindrical or prismatic form, and ground and polished plano or coquill glasses, wholly or partly manufactured, with the edges unground, 40 per centum ad valorem; with the edges ground or beveled, 10 cents per dozen pairs and 35 per centum ad valorem; strips of glass not more than three inches wide, ground or polished on one or both sides to a cylindrical or prismatic form, including those used in the construction of gauges, and glass slides for magic lanterns, 35 per centum ad valorem.

PAR. 227. Optical glass or glass used in the manufacture of lenses or prisms for spectacles, or for optical instruments or equipment, or for optical parts, scientific or commercial, in any and all forms, 45 per centum ad valorem.

PAR. 228. Azimuth mirrors, sextants, and octants; photographic and projection lenses, opera and field glasses, telescopes, microscopes, and other optical instruments, and frames and mountings for the same; all the foregoing not specially provided for, 45 per centum ad valorem.

PAR. 229. Incandescent electric-light bulbs and lamps, with or without filaments, 20 per centum ad valorem.

PAR. 230. Stained or painted glass windows, and parts thereof; and all mirrors, not specially provided for, not exceeding in size one hundred and forty-four square inches, with or without frames or cases, 50 per centum ad valorem; and all glass or manufactures of glass or paste, or of which glass or paste is the component material of chief value, not specially provided for, 50 per centum ad valorem.

PAR. 231. Smalts, frostings, and all ceramic and glass colors, fluxes, glazes, and enamels, all the foregoing, ground or pulverized, 30 per centum ad valorem; in any other form, 40 per centum ad valorem; opal, enamel or cylinder glass tiles, tiling, and rods, 40 per centum ad valorem.

PAR. 238. Watch crystals, 60 per centum ad valorem.

SCHEDULE 14. SUNDRIES

PAR. 1415. Emery, corundum and artificial abrasive grains and emery, corundum and artificial abrasives, ground, pulverized, refined, or manufactured, 1 cent per pound; emery wheels, emery files, and manufactures of which emery, corundum or artificial abrasive is the component material of chief value, not specially provided for; and all papers, cloths, and combinations of paper and cloth, wholly or partly coated with artificial or natural abrasives, or with a combination of natural and artificial abrasives; all the foregoing, 20 per centum ad valorem.

PAR. 1455. All thermostatic bottles, carafes, jars, jugs, and other thermostatic containers, or blanks and pistons of such articles, of whatever material composed, constructed with a vacuous or partially vacuous insulation space to maintain the temperature of the contents, whether imported, finished or unfinished, with or without a jacket or casing of metal or other material, shall pay the following rates of duty, namely: Having a capacity of one pint or less, 15 cents each; having a capacity of more than one pint, 30 cents each; and in addition thereto, on all of the foregoing, 45 per centum ad valorem; parts of any of the foregoing not including those above mentioned, 55 per centum ad valorem: *Provided*, That all articles specified in this paragraph when imported shall have the name of the maker or purchaser and beneath the same the name of the country of origin legibly, indelibly, and conspicuously etched with acid on the glass part, and die stamped on the jacket or casing of metal or other material, in a place that shall not be covered thereafter: *Provided further*, That each label, wrapper, box, or carton in which any of the foregoing are wrapped or packed, when imported, shall have the name of the maker or purchaser and beneath the same the name of the country of origin legibly, indelibly, and conspicuously stamped or printed thereon.

PAR. 1459. That there shall be levied, collected, and paid on the importation of all raw or unmanufactured articles not enumerated or provided for, a duty of 10 per centum ad valorem, and on all articles manufactured, in whole or in part, not specially provided for, a duty of 20 per centum ad valorem.

FREE LIST

PAR. 1501. Hydrofluoric acid.

PAR. 1513. Arsenious acid or white arsenic.

PAR. 1532. Borax, crude or unmanufactured, and borate of lime, borate of soda, and other borate material, crude and unmanufactured, not specially provided for.

PAR. 1561. Cryolite, or kryolith.

PAR. 1658. Selenium, and salts of.

PAR. 1667. Sodium: Nitrate, sulphate, crude, or salt cake, and niter cake.

PAR. 1677. Sulphur in any form, and sulphur ore, such as pyrites or sulphuret of iron in its natural state, and spent oxide of iron, containing more than 25 per centum of sulphur.

PAR. 1690. Uranium, oxide and salts of.

PAR. 1707. Works of art, productions of American artists residing temporarily abroad, or other works of art, including pictorial paintings on glass, imported expressly for presentation to a national institution or to any State or municipal corporation or incorporated deligious society, college, or other public institution, including stained or painted window glass or stained or painted glass windows which are works of art when imported to be used in houses of worship and when ordered after the passage of this Act, valued at $15 or more per square foot, and excluding any article, in whole or in part, molded, cast, or mechanically wrought from metal within twenty years prior to importation; but such exemption shall be subject to such regulations as the Secretary of the Treasury may prescribe.

Analyses of Coals

The results of analyses of hundreds of coals from 25 states and Alaska are given in Bulletin 193, "Analyses of mine and car samples of coal collected in the fiscal years 1916 to 1919," by Arno C. Fieldner, Walter A. Selvig, and J. W. Paul, just issued by the United States Bureau of Mines. Information as to the heating values of all coals tested is also given in the bulletin, which should be of interest to all extensive users of coal fuel. Information regarding coal sampling and analytical methods employed by the Bureau of Mines and a bibliography on the coal resources of the world are contained in the bulletin which is distributed through the Superintendent of Documents, Washington, D. C.

The Glass World and What It Is Doing

News of the Industry Briefly Told

Danish Glass Industry, 1921*

Collective statistics of the seven Danish glass works for 1921 have just been made public. The Danish glass industry has suffered heavily during the last several years; for the greater part of 1917 and repeatedly at other times during the war it was necessary to suspend operations for lack of coal and raw materials, and after a short period of prosperity in the year 1919 the industry found itself with difficulty able to cope with foreign competition, and this bad tendency continued throughout 1921.

Normally the industry requires about 1,200 men and this normal was practically attained in 1921, but by February, 1921, the number had become reduced to two-thirds, by the middle of the year to two-fifths and by the end of the year to one-third. The average for the whole year was 550 men.

Production by years from 1916 to 1921, inclusive, and for 1913, the year before the war, is given as follows:

	Bottles (Unit, 1,000)		Other Kinds of Glassware (Unit, 1,000 kg.)	Total Value (Unit, 1,000 kg.)
	Green	White or Semi-White		
1913	23,681	8,337	1,378	3,262
1916	22,992	10,150	2,584	6,468
1917	7,681	9,587	1,749	4,254
1918	11,835	12,917	1,628	7,516
1919	24,553	15,714	1,977	12,211
1920	22,467	12,058	2,272	15,024
1921	12,848	4,294	572	5,856

For reduction to dollars it is noted that the average exchange value of the crown (krone) in 1921 was 5.65 and in 1920 6.45 to the dollar. The averages for the years from 1916 to 1919, inclusive, are not available. In 1913 the par gold rate of the crown prevailed (3.73 to the dollar).

Of the dark green bottles embraced in the foregoing table as manufactured in 1921, 10,576 were half bottles, and of the white bottles 2,320 were halves. Included under white bottles were 507 milk bottles, 944 medicine bottles and 363 of other kinds.

In the following table showing domestic production as well as imports and exports of bottles it has been necessary to reduce the number of bottles as shown in the preceding table to kilograms, since statistics of import and export are kept only by weight:

	Domestic Production (Unit, 1,000 Kg.)	Export of Domestic Products	Imports for Consumption	Consumption
1913	12,292	618	737	12,411
1916	12,683	9	11,596	24,270
1917	5,409	7	7,121	12,523
1918	7,804	16	4,307	12,095
1919	12,454	13	3,545	15,986
1920	11,790	463	6,633	17,960
1921	6,425	285	2,714	8,854

It will be noted that practically no glass was exported in the years from 1916 to 1919, inclusive, and that at best shipments of glassware abroad are almost negligible. The unusually heavy importation of glass in 1916 is explained by the fact that large shipments were received from Germany in that year and sent back filled with milk, cream, beer, etc. The reason for the big drop in importations of glassware in 1921 is accounted for by the glutting of the market in the two previous years both through increased production and imports.

The following table shows the production, and export and import of glassware of various kinds exclusive of bottles and also exclusive of fully manufactured electric light bulbs and children's playthings of glass. Under imports are included among other things unmounted bulbs for electric lights and optical glass, etc.:

	Production (Unit, 1,000 kg.)	Export of Domestic Products	Imports for Consumption
1913	1,378	110	1,346
1916	2,584	785	2,640
1917	1,749	193	1,517
1918	1,628	235	793
1919	1,977	497	1,604
1920	2,272	579	2,118
1921	572	68	1,869

As to countries of origin of bottles and other glassware imported, no later statistics than for 1920 are available. The following table gives importations distributed by countries of origin for the year named of the principal kinds of glasswares expressed in metric tons:

	Germany	Belgium	Great Britain	Czechoslovakia	Sweden	All Other Countries
Mirror glass	167	18	..	7	..	5
Beveled plate glass	510	187	9	..	..	42
Window glass	1,524	4,828	421	8	..	287
Bottles and demijohns	6,227	..	32	210	199	29
Lamps, chimneys, globes etc.	408	..	..	33	4	30
Household glass	620	10	5	20	20	63
Technical glass	170	..	9	..	49	6
Electric bulbs	85	..	..	..	13	62
Cut and etched glass	358	81	..	70	46	152
Optical and photographic glass	118	12	44	..	..	3
Diverse, including glass in combination with metal	88	4	6	..	..	8

Included in the last column are imports from the United States of 40 tons of household glass, 15 tons of bottles, 8 tons of cut and etched glass and 20 tons each of beveled plate and common window glass. The principal other items included in this column are importations from Holland of 51 tons of electric bulbs, 205 tons of window glass and 20 tons of beveled plate glass.

Glass fruit jars are employed only to a limited extent for preserving fruits and vegetables, their high price militating against their so general use as to make domestic preserving a useful economic factor. The wholesale price of plain glass jars without tops as given by one of the leading glass works, is as follows:

Size	Price per 100
¼ liter	Kr. 16.50
½ "	" 26.00
1 "	" 42.00
2 "	" 63.00
3 "	" 94.00
4 "	" 115.00

The retail prices for jars with tops for airtight sealing are more or less as follows:

Size	Price per jar
¼ liter	1.25
½ "	" 1.40
1 "	" 1.60
2 "	" 2.15

The prices stated apply to all purchases in lots of less than 3,000 jars. It may be noted that Danish retail merchants as a rule make no reduction because of purchase of merchandise in quantity.

*By Marion Letcher, American Consul-General, Copenhagen, Denmark, July 24, 1922.

British Foreign Trade in Glassware*

While imports of ceramics into the United Kingdom during the first half of 1922 reflected considerable fluctuations in quantities contrasted with the like period of 1921, the majority of glass and glass manufactures recorded increases. From the appended statement it will be seen, however, that the general average of import prices showed a downward tendency.

The aggregate weight of British exports of ceramics was only slightly higher than in 1921, namely, 1,542,594 hundredweights against 1,539,421, gains in certain descriptions being nearly counterbalanced by reduced exports in others. Of glass and glassware the current year disclosed lower quantities except only in respect of plate and sheet glass. The statement below gives quantities and average export prices for the first half of 1921 and 1922:

British Exports

GLASS AND GLASSWARE

		Quantities. 1921.	Quantities. 1922.	Average price per unit. 1921.	Average price per unit. 1922.
Scientific (except tubing and rod)	Value			£43,229	£31,909
Tubing and rod for all purposes	Cwts.	1,168	490	£ 9 9s. 3d.	£ 8 14s. 0d.
Illuminating	Cwts.	3,095	2,598	£16 13s. 1d.	£10 11s. 10d.
Machinery	Cwts.	5,577	2,744	£10 3s. 11d.	£ 8 15s. 10d.
Domestic and fancy (including cooking utensils, tableware and ornamental	Cwts.	6,739	5,589	£18 10s. 10d.	£13 9s. 6d.
Plate and sheet	Cwts.	183,641	220,220	£ 3 5s. 2d.	£ 2 11s. 3d.
Optical (except worked elements)	Cwts.	1,961	411	£20 13s. 3d.	£27 6s. 0d.
Bottles and jars	Gross	170,074	161,045	£ 1 15s. 7d.	£ 1 9s. 3d.
Manufactures not elsewhere specified	Cwts.	2,186	2,216	£11 10s. 0d.	£ 8 7s. 0d.

British Imports

GLASS AND GLASSWARE

Scientific glassware (except tubing and rod)	Value			£66,524	£32,538
Glass tubing and rod for all purposes	Cwts.	1,826	2,215	£ 9 15s. 0d.	£ 3 18s. 2d.
Illuminating power	Cwts.	39,624	64,383	£ 5 9s. 9d.	£ 2 7s. 9d.
Machinery glassware	Cwts.	700	84	£ 4 12s. 9d.	£12 11s. 5d.
Domestic and fancy glassware (including cooking utensils, table glassware, ornamental glassware)	Cwts.	160,154	229,174	£ 4 14s. 2d.	£ 3 2s. 7d.
Plate and sheet	Cwts.	272,340	418,985	£ 2 5s. 4d.	£ 1 17s. 7d.
Optical glass (other than worked elements, e. g. lenses)	Cwts.	372	98	£11 7s. 9d.	£10 12s. 0d
Bottles and jars	Gross	498,482	610,076	£ 1 6s. 5d.	16s. 1d.
Glass and glassware not elsewhere specified	Cwts.	4,447	5,180	(Value £19,969)	(Value £16,610)

*From Alfred Nutting, clerk at American Consulate-General, London, July 18, 1922.

American Window Glass Annual Report

At the annual meeting of the American Window Glass Company, at Pittsburgh, Pa., on October 17, the annual report of the president, W. L. Munro, disclosed a very satisfactory condition of the company's finances. The general sheet as of August 25, 1922, follows:

ASSETS

Cash, notes and accounts receivable	$3,872,287.25
U. S. Liberty bonds and treasury certificates	812,500.00
Finished product, materials and supplies	2,875,554.65
Deferred charges	92,500.77
Plants, real estate and good-will	21,953,506.18
Investments	70,267.21
Treasury stock	5,000.00
Total	$29,681,616.06

LIABILITIES

Accounts payable for materials, wages, etc.	$482,041.37
Preferred stock dividend, payable Sept. 1, 1922	140,000.00
Royalty payable	479,156.04
Reserve for taxes	1,097,741.96
Reserve—for depreciation of plants and equipment and doubtful accounts and notes receivable	2,576,732.34
Preferred capital stock	4,000,000.00
Common capital stock	13,000,000.00
Profit and loss—Surplus	7,905,944.35
Total	$29,681,616.06

Following is a summary of income—profit and loss—for the period ended August 29, 1922:

Net profit from operations		$2,588,172.76
Other income		309,120.20
Total income		$2,897,292.96
Deductions from income—		
Reserved for Federal taxes	$170,782.20	
Royalty	1,578,453.74	
Other charges	101,528.73	
		1,850,764.67
Surplus for year		$1,046,528.29
Surplus, August 26, 1921		7,326,047.31
Total surplus		$8,372,575.60
Deductions from surplus—		
Dividends on stock	$442,141.25	
Charges applicable to prior year's operations	24,490.00	
		466,631.25
Surplus, August 25, 1922		$7,905,944.35

The February Ceramic Convention

Plans for the "Silver Jubilee Convention" at Pittsburgh, Pa., which will celebrate the 25th anniversary of the American Ceramic Society are being actively advanced. Arthur E. Williams, secretary of the Glass Division, recently sent a communication to members requesting that additional papers be submitted to be read at the four meetings scheduled for the division.

An exhibition of ceramic objects showing the developments of the past 25 years will be featured. Members having examples of early American pottery and glass are asked to lend these during the period of the exhibit. The various exhibits will be classified as follows: A. Utilitarian White Ware; B. Electrical Porcelain; C. Chemical Porcelain; D. Sanitary Ware; E. Terra Cotta; F. Floor and Wall Tile; G. Faience; H. Art Pottery; I. Chemical Stoneware; J. Utilitarian Stoneware; K. Glass; L. High School Pottery; M. Universities and Bureaus; N. Refractories.

To Make Glass by Fourcault Process

The recent organization of a $1,000,000 corporation, consolidating the Blackford Window Glass Company, and the Indiana Window Glass Company, both of Vincennes, Ind., has been followed by an announcement by Frank Bastin, president of both companies, that as soon as plans are received from England construction will be started on a 6-story plant to be equipped as previously announced for making sheet glass by the Belgian Fourcault process, besides which a specialty shop for grinding, polishing and beveling will be erected and the company's old clay plant re-established. The officers of the new Blackford Window Glass Company are Frank Bastin, president; Charles A. Weisert, vice-president; R. J. Dogneaux, secretary; Ira D. Schafer, treasurer. The directors are: Antone Simon, chairman; C. B. Kessinger, Henry Ostendorf, John T. Brokhage, Jules Grumiaux, John B. Schmidt and R. DuBois. A description of the Fourcault process was printed in the August, 1921, issue.

Miscellaneous Items

The article printed in our October issue on "The Production of Colorless Glass in Tank Furnaces," by A. Cousen, B. Sc., and W. E. S. Turner, D. Sc., should have been credited to the *Journal of the Society of Glass Technology*, in the August, 1922, issue of which it first appeared.

An increase averaging about 10 per cent in window glass prices was announced by the American Window Glass Company to take effect October 17.

Twenty-three pottery firms and twenty-four individuals, members of the Sanitary Potters' Association, were indicted recently by the Federal Grand Jury, at New York, under the Sherman Anti-Trust Law.

At the Leipzig Sample Fair, held August 27 to September 2, there were over 500 exhibits of glassware, including hollow and illuminating ware, plate glass, mirrors, chemicals and medical apparatus, art glass, cut glass and other branches.

The improved conditions in the industry are reflected by the demand for glass working machinery, several makers of automatic equipment reporting the receipt of orders in large numbers. The Miller Machine & Mold Company of Columbus, O., report their factory now working 100 per cent on orders and 55 hours a week.

Patent Decisions of the Federal Court at Pittsburgh were upheld in an opinion handed down by Judge Woolley of the United States Circuit Court of Appeals at Philadelphia, Pa., early in October. The plaintiffs were the Window Glass Machine Company and the American Window Glass Company who appealed against a decree declaring non-infringement by the Pittsburgh Plate Glass Company of a number of patents relating to the manufacture of glass by machinery.

A decision in favor of Macbeth-Evans Glass Company in their case against the L. E. Smith Glass Company of Mt. Pleasant, Pa., reversing the judgment of the Western District Court was handed down by the Circuit Court at Philadelphia, Pa., in October. The appeal of the Macbeth-Evans Company was from the decision of the lower court which held "invalid for want of invention" letters patent for an automobile head light, which the company claimed had been infringed.

Verified News of Trade Activities

The Licking Window Glass Company, Utica, O., are installing a flowing glass machine process.

The Atlantic Bottle Co., Brackenridge, Pa., plans to rebuild, at a cost of $300,000, its factory, which was recently destroyed by fire.

The Ruth Glass Company, Conshohocken, Pa., has plans under way for the rebuilding of its plant which was destroyed by fire some time ago.

The factory and equipment of the **Industrial Glass Manufacturing Company's** plant at Cameron, W. Va., will be sold at public auction at 10 A. M. on November 9.

The Falconer Plate Glass Corporation, Falconer, N. Y., has been incorporated with a capital of $150,000 to deal in plate glass and manufacture mirrors. The incorporators are: E. A. Peterson, S. O. Merriman and B. H. Tefft.

The Salem Glass Works' plant at Salem, N. J., was destroyed by fire on October 16, at an estimated loss of $175,000. It is reported that the plant, which employs over 500 glass workers, will be rebuilt at once.

Fires were lighted at the plant of the **Niles Glass Division** of the **General Electric Company,** at Niles, Ohio, on October 16, and production will be started during November. The plant will operate at about 20 per cent working capacity.

The Fort Pitt Glass Company, Pittsburgh, Pa., through S. A. Greenlee, H. F. Gabel and K. A. Maratta, will make application on November 6, for a charter of incorporation. The purpose of the company is to manufacture and sell glass and glassware.

The Canton Glass Company, Marion, Ind., F. L. Paul, secretary, report that they have rebuilt the 40,000 gallon water supply tank, which collapsed on September 26, and that the plant resumed the manufacture of glassware on October 5.

A motion to enable the receivers to sell the property of the Modern Glass Company, Toledo, O., if a suitable offer can be obtained was granted recently by Judge Killitts. Fresh attempts to reorganize the company are being made.

The Genessee Cut Glass Corporation, Rochester, N. Y., has been incorporated with a capital stock of $11,000, to manufacture and sell cut glass. The directors are Theron E. Bastian, G. B. Tuthill and John A. Barth.

Announcement has been made that due to the completion early next year of a new unit representing an investment of about $800,000 the operating capacity of the subsidiary plant of the **Hazel-Atlas Glass Company** at Zanesville, O., will be greatly increased.

The Illinois-Pacific Glass Company, San Francisco, Cal., manufacturers of hollow ware bottles, pressed ware, etc., has leased a three-story building, 124 by 200 feet, and plans are being prepared for remodeling the building at a cost of $125,000.

The National Sash & Door Company's plant at Independence, Kans., was threatened with destruction on October 9, when 200 tons of molten glass burst through a weak place in the tank, but, fortunately, the only loss was damage to the tank, estimated at about $5,000.

The Pennsylvania Glass Sand Company's Glendower works, at Mapleton, Pa., recently resumed operations after being closed down since early in January, 1921. Improvements and general repairs to the works have been made during the past few months. The company reports business as being very active.

The Berney-Bond Glass Company, Clarion, Pa., is rebuilding only part of its plant which was recently destroyed by fire with an estimated loss of $400,000. The new building will be of fire-proof construction. The company has not decided whether it will rebuild the balance of the factory at Clarion or at another location.

The Co-Operative Cut Glass Works, 446 Ash St., New Bedford, Mass., has recently been organized to manufacture glass products. G. G. Enos heads the company. Frank E. Sadler, manager, states that they will be glad to receive catalogs from cut glass equipment manufacturers, and that the company expects to add five frames to their equipment next year.

The Roanoke Glass Company, jobbers and wholesale dealers in plate, window and prism glass, Roanoke, Va., has been incorporated with a capital stock of $100,000, with the following officers: R. H. Angell, president; C. B. Wilson, vice-president; M. F. Ring, treasurer; C. R. Williams, secretary, and M. P. Watkins, manager.

Travers & Clarke, Ltd., glass technologists, Waldorf Chambers, 11 Aldwych, London, W. C. 2, England, announce that they are the authorized agents for the British Isles, Europe and India of the Amsler-Morton Company, glass-house engineers and builders of lehrs, furnaces, etc., Pittsburgh, Pa.

The Elk Run Window Glass Company, Punxsutawney, Pa., after summary repairs to its plant, which was damaged by fire on October 4, resumed operation on October 12. The total loss was about $10,000, and the departments most seriously damaged included the batch room, tool house, engine shed and a large section of the tank house. Raymond Dereume reports that they are in the market for batch scales.

Stockholders of the United States Glass Company at a special meeting held in Pittsburgh on October 4, voted approval of the directors' plans, announced some time ago, for reorganizing the company under the name United States Glass Corporation. This action is said to have been taken to provide for the coming due in 1923 of company bonds to the amount of $389,000. The company's affairs were reported by the president, M. G. Bryce, to be in a prosperous condition.

The Seamless King Glass Company has been organized at Poteau, Ark., by Joseph Conway, Jesse Bolton and Harry Clements. The company has purchased the plant of the Hiatt Glass Company at Poteau which will be remodeled and made ready for operation early in December. Improvements will also be made in the ovens and a grinder and other machinery for making glass cylinders will be installed. Glass cylinders

for filling stations and five-gallon water bottles will be manufactured by the company.

The Sterling Glass Company, Lapel, Ind., has been purchased by the Thompson-Taylor Company, Chicago, Ill., and will be operated under the old name. John D. Warfield, president, reports that sufficient capital has been provided to take care of all requirements of a modern glass factory and that the company will make standard types of bottles, such as are used by extract manufacturers and spice houses. The officers of the company are: John D. Warfield, president; George E. Hurd, vice-president; Thomas W. Algeo, secretary-treasurer, and Arthur Woodward, manager.

George F. Collins & Company, recently incorporated at Sapulpa, Okla., by George F. Collins, has purchased the plant of the Hutton-Bates Glass Company, at Poteau, Okla., and will manufacture high grade machine made flint bottles, specializing in vinegars. The capacity of the Hutton-Bates plant is being practically doubled. New equipment has been installed and it is expected that operation will be resumed about November 15. Mr. Collins at present operates a large milk bottle plant in Sapulpa, but it is reported that on account of the uncertain gas supply and its high cost, he expects to close down his property at that point and transfer his activities to Poteau.

The Scott-Warman Glass Company's factory at East Stroudsburg, Pa., which was entirely destroyed by fire last January has been replaced with a modern fire-proof building, 175 by 300 feet, almost three times the size of the building which was burned. All the machinery in the old plant was destroyed and in its place has been installed the latest equipment for bottle making. The new plant is about completed and will be in operation early in November. It will put the company in a position to make thirty tons of high-grade bottles daily and being located on the main line of the Lackawanna railroad, only 75 miles from New York, carload shipments from the factory siding can be delivered in New York in eight hours.

Personal News

H. E. Devaughn has completed his work at the new plant of the United States Sheet & Window Glass Company at Shreveport, La., where he was in charge of construction, and is now superintendent of the company's plant at Morgantown, W. Va.

Dr. S. W. Stratton, director of the Bureau of Standards of the Department of Commerce, Washington, D. C., who has devoted the past 21 years to building up the Bureau to the point where it is the largest physical laboratory in the world, has resigned to become president of the Massachusetts Institute of Technology.

J. M. Neenan, who for many years was president of the National Window Glass Workers, is now at Shreveport, La., as works manager for the United States Sheet & Window Glass Company, whose immense new plant was described and illustrated in the September number of THE GLASS INDUSTRY.

Recent Deaths

Dr. Chauncey William Waggoner, head of the department of physics in West Virginia University, Morgantown, W. Va., died on October 27th at Shreveport, La., from injuries received when he was thrown from his horse. Dr. Waggoner was on a leave of absence from the University to do special research work on glass technology for the United States Bureau of Standards. The deceased was connected with the United States Window Glass Company of Morgantown, W. Va., and the United States Sheet and Window Glass Company of Shreveport, La., as consulting engineer. He was a graduate of Cornell University. Dr. Waggoner is survived by his widow and two sons.

Lester E. Partridge, of the Sharp-Partridge Company, Chicago, Ill., died on October 10, several days after an operation for appendicitis. Mr. Partridge was 53 years of age and, having been associated all his life with the glass distributing trade, was well known and much liked by hosts of friends. His widow and two daughters survive him.

William B. Weddle, a retired New York cut glass manufacturer, died recently at the home of his daughter, Mrs. F. C. De Angelis, East Orange, N. J.

Inquiries Received

For further information address THE GLASS INDUSTRY.

91.—Can you give us the names of manufacturers of unit prism glass?

92.—Kindly give us the names of manufacturers of batch scales.

93.—We are manufacturing violet ray electrodes and would like the names of manufacturers of glass tubing for use in making these electrodes. Also equipment for this class of manufacturing.

94.—Can you give us the names of manufacturers of stencils for use in sand blasting letters, designs, etc., on various kinds of glassware.

95.—We are desirous of obtaining large quantities of a heat-resisting glass or "quartz glass" 1/32 inch thick, made in plates or flat tubing into which we can seal by heat aluminum plates about 4 inches long, 2 inches wide and 1/32 inch thick. We will place orders for lots of 50,000 plates or 50,000 feet of tubing.

96.—(From France.) We would like the addresses of builders of machinery for the automatic production of electric bulbs.

97.—(From India.) We desire to add to our factory a cut glass department and want to obtain full particulars as to modern equipment, supplies and methods.

98.—(From Germany.) Please put us in touch with parties who control automatic machines for making glass tubing.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, OCTOBER 25, 1922

	Bid	Asked	Last
American Window Glass Machine, com....	85	86	85
American Window Glass Machine, pfd.....	92	..	95
American Window Glass Preferred.....	106	..	107
Pittsburgh Plate Glass.....	175	..	175
U. S. Glass	..	50	46

During the past month, a strong undertone has characterized the market. While there has been no pronounced activity, still all of the glass issues maintained steady price levels and most of them reflect the improved operating positions of the different companies. Orders continue to be placed at a satisfactory rate and the reports of practically all companies are characterized by profitable operating figures.

WHEELING STOCK EXCHANGE, OCTOBER 25, 1922

	Bid	Asked	Last
Hazel-Atlas	158	162	162
Imperial Glass	95	100	86
Fostoria Glass	116	..	117
Central Glass	90	100	100

The past month has been characterized by an inactive and sluggish market. The only outstanding issue from a trading standpoint during the month was Imperial Glass; and this was due to the fact that the directors of the company recently authorized payment of a second dividend of 1¼% within a month. It is announced that early next year the subsidiary plant of Hazel-Atlas Glass, operating at Zanesville, Ohio, will have increased operating capacity, due to the completion of a new unit that represents an investment of around $800,000.

TOLEDO STOCK EXCHANGE, OCTOBER 25, 1922

	Bid	Asked	Last
Owens Bottle Machine, common.....	38¾	39½	39¾
Owens Bottle, preferred	104⅞	...	105
Libbey-Owens Sheet Glass, common...	130	135	132
Libbey-Owens Sheet Glass, preferred...	104¼	106	105

Current Prices of Glass-Making Materials

From quotations furnished by various manufacturers and dealers

October 27, 1922

	Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)..lb.	.05½	.06
Aluminum oxide (Al_2O_3).....lb.	..	..
Antimony oxide (Sb_2O_3).. ...lb.	.07–.08	.08-.10
Arsenic trioxide (dense white), 99% (As_2O_3).....lb.	.10–.10½	.11–.12
Barium carbonate ($BaCO_3$)...ton	75.00	90.00
Barium hydrate ($Ba(OH)_2$)....lb.	.05½	..
Bone ash .....lb.	.05½	.07½
Borax ($Na_2B_4O_7 10H_2O$) .....lb.	.05½	.06
Borax, fused, any mesh ($Na_2B_4O_7$) .....lb.	.19	.20
Boric acid, fused (B_2O_3).....lb.	.35	.35
Cadmium Sulphide, red (CdS)..lb.	..	1.60
Cadmium Sulphide, orange.....lb.	..	1.80
Cadmium Sulphide, yellow (CdS) .....lb.	..	1.90
Chrome oxide .....lb.	.34	..
Cobalt oxide, in bbls. (Co_2O_3)...lb.	..	2.20
Cobalt oxide, in 10 lb. tins (Co_2O_3) .....lb	..	2.35
Copper oxide, red.....lb.	.13	.15
Copper oxide, black (CuO).....lb.	..	.26
Copper oxide, black prep'd (CuO) .....lb.	..	.30
Cryolite (Na_3AlF_6) .....lb.	..	.09½
Feldspar, 100 mesh.....ton	15.00	25.00
Fluorspar, powdered white, 95% (CaF_2) .....ton	35.00	45.00
Fluorspar, powdered white, 90% (CaF_2) .....ton	33.00	38.00
Hydrofluoric acid (HF) 60%..lb.	.13	..
Kaolin .....ton	17.00	25.00
Lead oxide (red lead) (Pb_3O_4)..lb.	.09⅝	.10
Litharge (PbO) .....lb.	.09⅛	.09⅜
Lime—		
Hydrated (in 50 lb. paper sacks) ($Ca(OH)_2$) .....ton	11.50	..
Burnt, ground, in bulk (CaO).ton	8.00	..
Burnt, ground, in paper sacks.ton	10.00	..
Burnt, ground in 280 lb. bbls. per bbl.	2.10	2.25
Manganese 85% (MnO_2).....lb.	.05	.05–.06½
Nickel oxide, black (Ni_2O_3) for nickel content .....lb.	..	.40–.50
Nickel monoxide, green (NiO) for nickel content.....lb.	..	.45–.50
Potassium carbonate—		
Calcined 90% (K_2CO_3).....lb.	.06¼–.06½	.07
Hydrated 90% (KOH) .....lb.	.06½	.08
Potassium nitrate (KNO_3) (gran.) .....lb.	.06½	.06¾–.09¼
Powdered blue .....lb.	..	.26
Powdered blue (std. formula)..lb.	..	.38
Salt cake, glassmakers, f. o. b. works (Na_2SO_4) .....ton	26.00	30.00–35.00
Selenium (Se) .....lb.	..	2.25
Soda ash, 58% dense, 48% basis		
Bulk (Na_2CO_3) .....100 lb.	1.22½	..
Bulk, on contract (Na_2CO_3) 100 lb.	1.17½	..
Sodium nitrate, refined ($NaNO_3$).lb.	..	.04¾–.06¼
Sodium selenite (Na_2SeO_3).....lb.	..	2.35–3.00
Sodium Fluosilicate (Na_2SiF_6)...lb.	.08	.08½
Sulphur (S) (flowers)—in bbls. per 100 lb.	3.25	3.55–3.80
Sulphur (flowers) Bags per 100 lb.	3.00	3.30–3.55
Sulphur (S) (flour, heavy), in bbls. per 100 lb.	2.50	2.80–3.05
Uranium oxide—100 lb. lots (UO_3) .....lb.	..	2.25
Zinc oxide (ZnO) .....lb.	.07	.08

Monthly Summary of United States Foreign Commerce in Glass

Corrected to October 5, 1922

IMPORTS

	August				Eight Months Ending August			
	1921		1922		1921		1922	
Glass and glassware:	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Bottles, vials, carboys, etc., plain, empty or filled, lbs. .....dut.	1,191,328	44,876	877,812	31,474	5,234,771	232,485	5,182,890	189,793
Bottles, decanters and other glassware, cut or ornamented .....dut.	.....	118,665	.....	229,570	.....	942,039	.....	1,384,656
Optical instruments, including lenses and spectacles .....dut.	.....	73,542	.....	100,094	.....	701,074	.....	815,264
Sheet and plate glass—								
Cylinder, crown and common window glass, unpolished .....lbs. dut.	3,927,522	209,186	3,329,273	142,537	441,096	1,962,552	38,311,491	1,932,411
Plate glass, cast, polished, unsilvered, sq. ft. dut.	124,208	74,827	1,263,421	576,085	1,661,477	1,262,867	5,251,428	2,360,761
Plates or disks, rough cut, for optical purposes .....lbs. free	10,840	16,038	3,587	9,887	559,041	504,672	235,953	86,866
All other.....dut.	.....	266,331	.....	311,359	.....	1,720,026	.....	2,049,814
Total	.....	803,465	.....	1,401,006	.....	7,325,715	.....	8,819,565

EXPORTS

Glass and glass products (total).....	.....	729,306	.....	663,441	.....	11,554,190	.....	5,615,036
Plate and window glass—								
Window glass, common, box, 50 sq. ft.....	620	4,319	2,854	16,103	51,993	415,067	21,142	116,126
Plate glass, unsilvered, sq. ft.....	140,040	58,548	90,150	40,280	1,697,699	1,048,954	1,949,246	835,445
Wire glass, sq. ft.....	.....	.....	13,351	3,982	.....	.....	173,430	45,081
Other window and plate glass, n. e. s.....lbs.	.....	.....	188,061	17,716	.....	.....	1,217,646	139,683
Glass containers (bottles, vials and jars).....lbs.	.....	319,213	4,039,235	213,583	.....	3,801,419	26,208,784	1,462,903
Table glassware, plain.....lbs.	.....	.....	1,672,225	156,200	.....	.....	7,341,880	828,473
Table and other glassware, cut or engraved....lbs.	.....	6,040	35,701	14,651	.....	135,969	267,177	101,780
Glassware for lighting—								
Lamp chimneys and lantern globes.....lbs.	.....	.....	82,495	18,912	.....	.....	903,155	191,287
Globes and shades for lighting fixtures.....lbs.	.....	.....	112,613	34,084	.....	.....	949,915	276,602
Lamps and other illuminating devices, chiefly of glass .....lbs.	.....	.....	62,758	20,620	.....	.....	728,032	264,879
Chemical glassware.....lbs.	.....	8,783	19,300	12,005	.....	170,832	199,937	104,617
Electrical glassware, except for lighting.....lbs.	.....	.....	287,415	14,051	.....	.....	1,321,657	105,836
Other glassware, n. e. s.....lbs.	.....	332,403	654,879	101,254	.....	5,981,949	9,418,795	1,142,324